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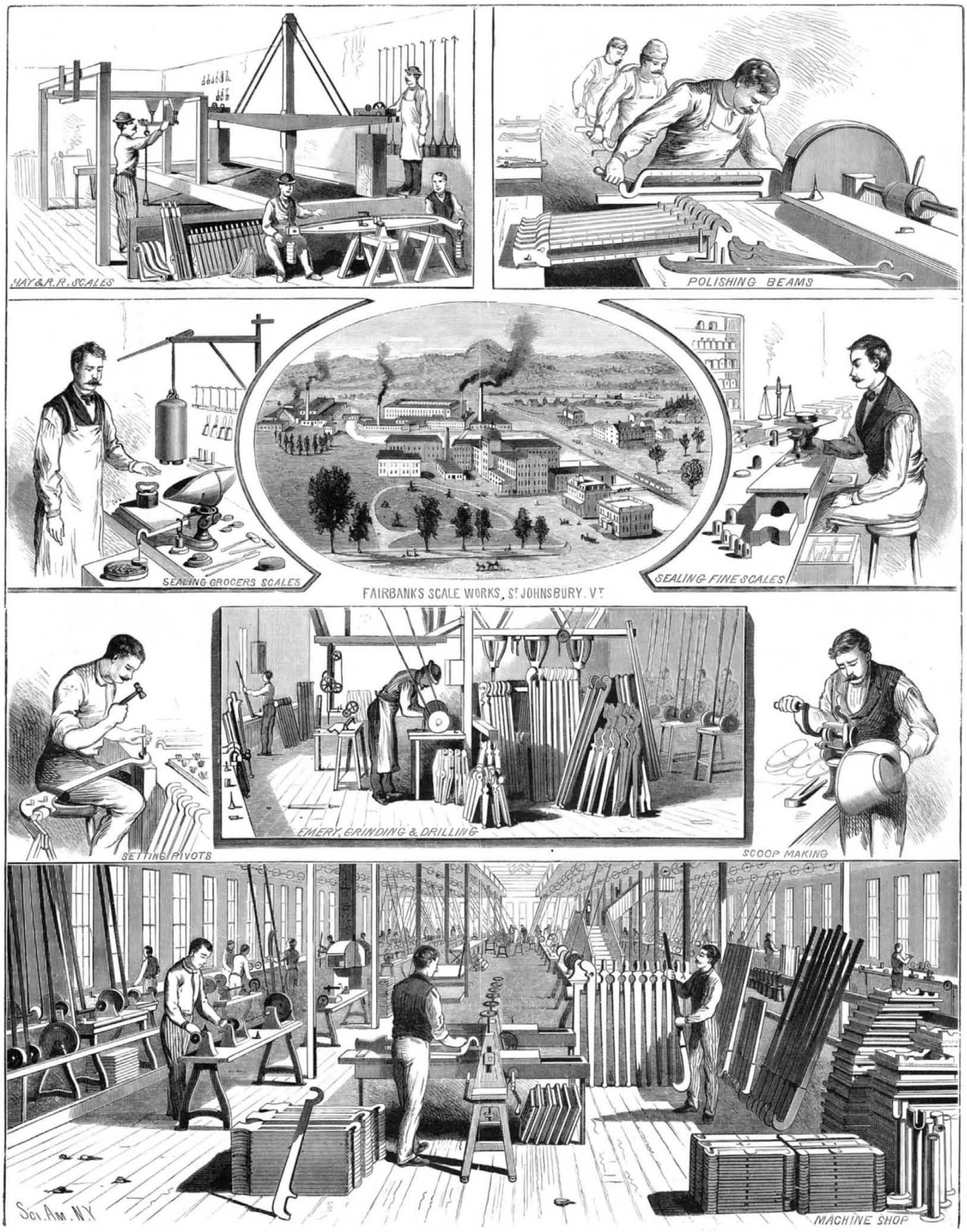

THE MANUFACTURE OF STANDARD SCALES.—E. & T. FAIRBANKS & CO.—[See page 290.]

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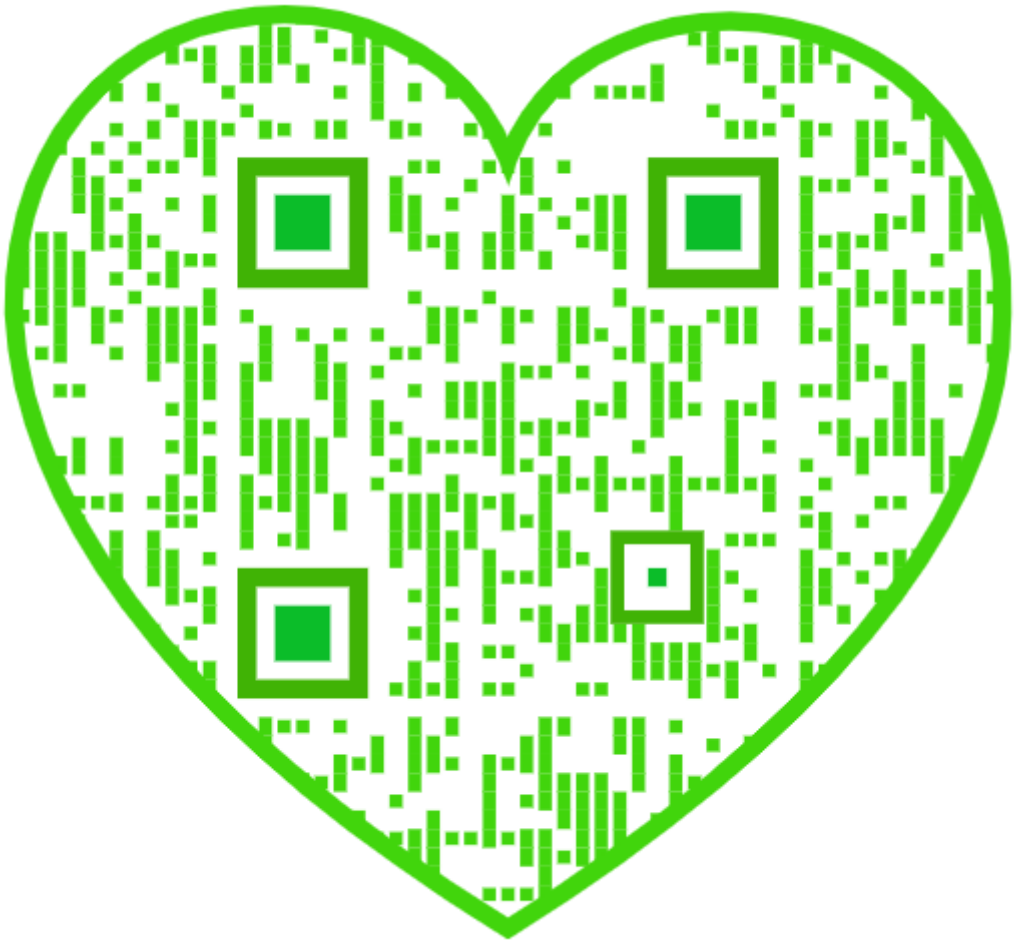

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NEW YORK, SATURDAY, NOVEMBER 6, 1880.

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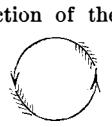
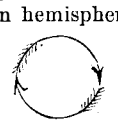
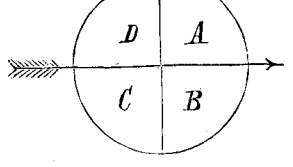
THE LAWS OF CYCLONES.

There seems to be no subject of equal importance so little understood as the laws governing the revolving storms of wind known as cyclones. That this should be the case among landsmen who rarely encounter them is not strange; but that sailors and *soi-disant* scientists should fall into gross errors in treating so simple a subject is not only unpardonable, but incomprehensible. The cyclone, as it is called in the northern hemisphere, or the typhoon, by which name it is known in the southern seas, is a revolving storm of wind, having a diameter of from 100 to 800 miles, and a spot of actual calm in the center. This storm revolves at a velocity increasing from the edges toward the center, where it sometimes attains a rate estimated at five miles a minute. The whole disturbance also moves forward at a speed varying between five to forty miles an hour. The great difficulty in understanding the phenomena of the cyclone is due to this double motion—a lateral movement of the whole storm over the face of the earth, and a revolving motion around its axis, or center. The general movement of the storm is confounded with the direction of the wind at any given point, and *vice versa*, so that oftentimes a captain, by putting his ship before the wind, in the idea of running away from the storm, is really steering straight into the track of its most dangerous part, namely, the center. Yet the means of knowing how to avoid this danger are so easily attainable that no captain nor mate ought to be allowed a berth on shipboard unless he is thoroughly acquainted with these simple rules.

Let us examine the conditions of the problem.

In the northern hemisphere the wind rotates "against the sun;" that is, opposite to the direction of the hands of a watch placed face upward, thus,  ; and in the southern hemisphere the motion is reversed, thus,  . Now it is evident that a vessel may come into the range of a cyclone by being overtaken by it—generally the case with sailing ships—or by running into the area of disturbance. In the first case the cyclone center will steadily approach her unless she runs in the right direction, while in the latter case it may be that she will feel the influence of the cyclone less and less as it draws away from her. The vessel must come into its influence in one of the quadrants indicated by the letters A, B, C, and D, in the figure, the direction of the forward motion being shown by the arrow.



So long as a ship was anywhere in either quadrant, A or B, she would feel a constantly increasing power of the wind, and would be in a steadily increasing danger. If a steamer should run into either of these quadrants she ought at once to take such a course as would carry her away from the center; while a sailing ship should do likewise so long as the wind and sea were not too heavy, and then "lie to" on the proper tack. If a steamer entered either C or D quadrants she would be obliged to change her course very little, if at all, and a sailing ship could actually derive a benefit from the cyclone by keeping in its edge as long as the wind and sea permitted her to do so.

Now the great question to be determined is: How can a captain tell which quadrant he is in when he enters a cyclone? First of all, he must always observe the weather and the barometer so closely as to know at the earliest possible moment when a cyclone is coming. Having assured himself that the approach of a cyclone is certain, he should carefully watch the wind and notice in which direction the shifts occur. These gradual changes in the wind's direction constitute the most marked features of the cyclone, since there is only one position in which they will not be immediately observed, namely, if the ship lies exactly in the path of the center of the hurricane in its onward course. When these changes in the direction of the wind have become clearly marked, he should apply the following rule, which is invariable in both hemispheres: When the shifts of wind occur from right to left, that is, say from north to west, west to south, south to east, or east to north, the observer is in quadrant A or quadrant D, that is, on the left hand side of the cyclone's advance facing in the direction in which it is moving; but if the shifts come from north to east, east to south, south to west, or west to north, the observer is in quadrant B or quadrant C, on the right of the storm's track. Knowing on which side the storm center will pass, it is an easy matter to avoid it. The difference between quadrants A and B and quadrants C and D will soon be discovered by the fact that in the first pair the storm will steadily increase, while in the two latter the strength of the wind will diminish. When a sailing ship has run away from the center as long as the wind and sea will permit her to do so, she must invariably follow this rule in "lying to:" If she is on the right hand side of the storm center's track she must "lie to" on the starboard tack, and on the port tack if on the left hand side. She will thus escape the danger of being caught aback by a shift of wind which might result in her sinking stern foremost.

If the weather and the barometer both clearly indicate a cyclone, but there are no shifts of wind, the captain may consider it certain that he is exactly in the path of the hurricane; and during the first few hours of the storm there is a direct relation between the rapidity with which the wind changes its direction and the proximity of the vessel to the cyclone's track: the slower that the shifts occur the nearer the vessel is to the path of the center, especially if the increase in the wind's strength is great; but if the shifts occur rapidly and steadily without a very great increase in force, the center will not pass very near. A careful seaman, consulting his experience and his barometer to discover the approach of a cyclone, observing carefully the foregoing rules to determine on which side of and how near him it is going to pass, and using a prudent discretion in avoiding its center, ought never to lose his ship.

THE CULTIVATION OF THE SUMAC.

There are thousands of people who wander through the woods in autumn picking the beautiful scarlet and yellow leaves of the sumac bush to decorate their rooms, without knowing that there is any other use for the plant. Yet the importation of the sumac into this country this year will amount to about 11,000 tons, costing about $1,100,000. The leaves of the sumac, dried and ground, are largely used in tanning and dyeing, and in Sicily and other parts of Italy the plant is carefully cultivated and treated. In view of the fact that the American sumac contains from 6 to 8 per cent more tannic acid than the Italian, and remembering that the plant grows wild in profusion throughout this country, it seems reasonable to believe that it might be made a very profitable crop. At the present time the amount of native sumac brought into market does not exceed about 8,000 tons yearly, and its market price is only $50 per ton, just half the price of the Italian product. This large difference in the market value of the foreign and the domestic article is due to the fact that the American sumac, as at present prepared, is not suitable for making the finer white leathers so much used for gloves and fancy shoes, owing to its giving a disagreeable yellow or dirty color. The many attempts that have been made to avoid this difficulty by care in collecting and grinding the leaves have not resulted in success, and it has long been supposed that this objectionable quality was inherent in the American plant; but Mr. Wm. McMurtrie, in a report to the United States Commissioner of Agriculture, shows that this difficulty can be surmounted and the American product made even superior to the foreign.

Mr. McMurtrie made a number of tests to learn the relative amounts of tannic acid found in the leaves at different periods of their development, and while the amount was found to be greatest in the leaves gathered in July, he found that those gathered in full development in June were even then more than equal to the best foreign leaves in this respect. But further, he found that the deleterious coloring matter (due to the presence of quercitrin and quercetin) was not yet developed, and that therefore the American leaves gathered in June were superior to the Italian for all purposes. The importance of this discovery may be seen by the fact that the cultivation of the plant may be carried on most profitably in this country as soon as manufacturers and dealers recognize the improvement thus obtained in the domestic article, and by classifying it according to its percentage of tannic acid and its relative freedom from coloring matter, advance the price of that which is early picked and carefully treated.

In Italy the sumac is planted in shoots in the spring in rows, and is cultivated in the same way and to about the same extent as corn. It gives a crop the second year after setting out, and regularly thereafter. The sumac gathered in this country is taken mostly from wild plants growing on waste land, but there is no reason why it should not be utilized and cultivated on land not valuable for other crops.

THE COLOR OF OZONE.

A paper recently read before the French Academy of Sciences contains some interesting facts relative to the liquefaction of ozone. A reservoir containing oxygen, at a temperature of 9·4° below zero (Fah.), is charged with ozone, and pressure applied by a column of mercury acted upon by a hydraulic press. Immediately the gas begins to turn to an azure blue color, deepening the shade as the pressure increases. The liquefaction of ozone was obtained by applying a pressure to the ozonized oxygen of 75 atmospheres, while 300 atmospheres of pressure would have been required for pure oxygen. The fact was also established that ozone is an explosive gas, since, unless compressed slowly and at a low temperature, it exploded with a yellow flame. Its heavenly blue color was rendered manifest not only under heavy pressure, but under all circumstances.

UNTIMELY SNOWS.

The retreating winter of the southern hemisphere goes out like a lion, while the first showings of our coming winter are by no means lamb-like.

A dispatch from Buenos Ayres says that a terrific snow storm occurred in that province September 18, causing the death, it was estimated, of 700,000 cattle, 500,000 sheep, and 250,000 horses.

On the 15th of October a furious storm fell upon Western Iowa, attended by a heavy fall of snow, which drifted seriously during the following day. On several railroads trains were blockaded by drifts from five to seven feet deep. The snow fell heavily in Southern Minnesota, causing great interruption of travel and telegraphic communication. The storm moved eastward slowly, raging with greatest fury over Lake Michigan, wrecking a number of vessels and causing a

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serious loss of life. Even as far east as Western New York the snowfall was from twelve to fifteen inches, and badly drifted. Between Buffalo and Rochester several freight trains were stalled, and the passenger trains of the morning of October 18 had to be abandoned. So early and so severe a snowfall is quite unusual.

THE CAPE COD CANAL.

From time to time, for the past two hundred years, the merchants and shipmasters of Boston and New York have agitated the question of severing, by a ship canal, the narrow neck of land between Buzzard's Bay and Barnstable Bay (the inner portion of Cape Cod Bay), and thus saving the dangerous passage around Nantucket and Cape Cod. More than a century ago a committee, favored by Washington, examined and reported upon the feasibility of the project, and recommended its execution on commercial and military grounds. The need of such a channel of inshore communication was severely felt during the war of 1812, and in the years immediately succeeding the war the project was often brought up for public consideration. Between 1818 and 1824 the route of the proposed canal was re-examined by order of the State authorities of Massachusetts, and in 1825 a careful survey was made by Major Perault, U. S. Engineer, under the direction of the President of the United States.

The results of the survey, with plans, estimates, etc., were laid before Congress in 1826. Two years later the Board of Internal Improvement adopted a route for the canal, and there was every promise of its early execution. But a change of administration occurred, and with it a reversal of the policy of the general government touching the question of internal improvements, and the affair was dropped for thirty years or more.

In 1860 the State authorities of Massachusetts revived the project, obtained the assistance of the Coast Survey, and got together much information directly bearing upon the feasibility and probable benefit to flow from the work.

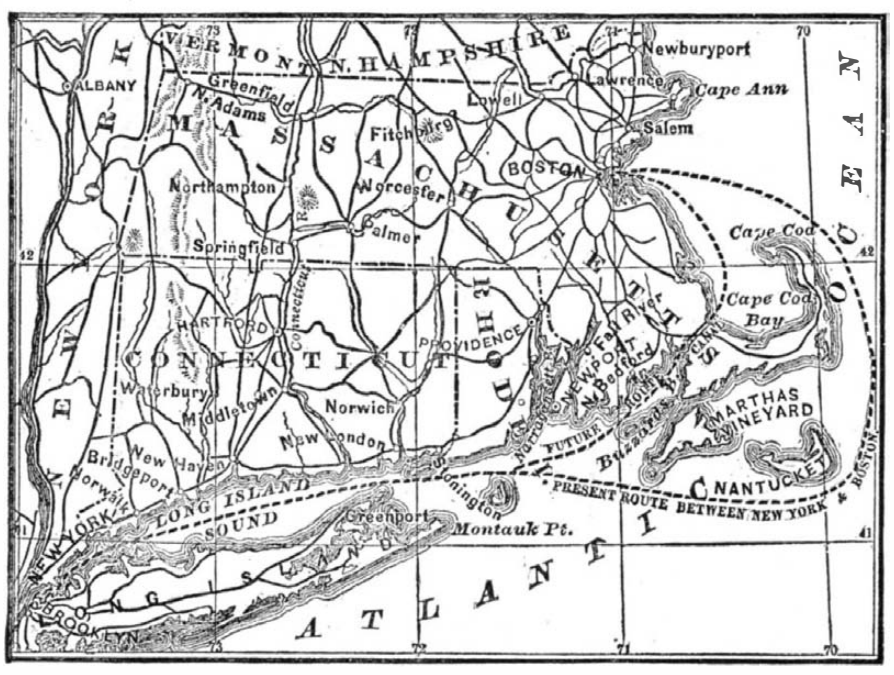
The exigencies of the war, however, prevented the carrying out of their plans at that time, and the years immediately following the war were not favorable for such enterprises. So the matter rested until a few months ago, when a merchant and shipbroker of this city took up the scheme, enlisted a number of New York capitalists in the enterprise, purchased, under an unexpired charter, a strip of ground a thousand feet wide across the neck of land to be severed, and set to work to dig the canal. The contract was given to Adam Driesbach and John Cameron, of New Jersey, and Mr. Geo. H. Titcomb was placed in charge as engineer.

The position of the proposed canal is shown in the accompanying map. The neck of land to be cut through is a little short of eight miles across. Two small rivers, the Monumet and the Scusset, make a shallow water way about seven-eighths of the distance, the narrow dividing ridge, five miles from Buzzard's Bay, rising only thirty-five feet above the average level of the bays on either side at low water. The earth to be removed consists mostly of gravel and is easy of excavation. The canal will be without locks, and owing to the difference in the times of high and low water in the two bays it is expected that a current of two miles or more an hour will traverse the canal four times a day. In width and depth the proposed canal compares with other ship canals as follows:

Canal.	Width at mean level. Feet.	Width at bottom. Feet.	Depth at mean level. Feet.
Cape Cod Canal	225	66	25
Caledonia Canal	110	50	20
North Holland Canal	123	31	20½
New Amsterdam Canal	191	87	23
Suez Canal	190	72	26

The direct advantages of the canal are the saving of ninety miles of distance and at least eight hours of time on the trip from New York to Boston. The incidental advantages are the avoidance of delays through fogs and rough weather while rounding Cape Cod; escape from the serious dangers attending the navigation of that dangerous coast, the present average loss by shipwreck on Cape Cod being something like 6,000 tons of vessel property a year, and from twenty to forty lives. In addition, the safe inshore route which the canal will provide will enable the popular Sound steamers, which cannot endure the outside passage, to run the entire distance to Boston. By this route steamers for freight and passengers will be able to leave New York in the evening and reach Boston early the next morning, making between the two cities one of the most inviting excursion routes imaginable. For general freight traffic between these ports—indeed for a large part of the coasting trade—the canal cannot fail to prove economical. It is estimated that not less than 40,000 vessels round the cape every year, carrying cargoes valued at $600,000,000. The friends of the canal expect that fully 4,000,000 tons of shipping will use the canal the first year. The saving in insurance, time, crew's expenses, etc., is estimated at $1,500,000.

The subscribed capital of the company formed for digging the canal is reported at $8,000,000, of which it is said that $1,500,000 have been paid in. The work is to be completed in two years, if the plans of the company are carried out.



THE CAPE COD CANAL.

A Five Hundred Dollar Comet.

To the Editor of the Scientific American:

I hasten to say to the astronomical readers of the SCIENTIFIC AMERICAN that on the evening of the 10th instant, just before midnight, I discovered a new comet in about right ascension 21 hours 30 minutes, declination north 17° 30′, or in the constellation Pegasus. It was very large, and its apparent motion so slow, and I have been so troubled to see it in the evening by moonlight and in the morning by haze and clouds, that I am yet uncertain regarding its direction and rate of motion. I can say, however, it is moving very slow, and probably west of north. Its slow apparent motion indicates that it is either moving nearly toward or from the earth.

It is so nearly in opposition to the sun (the earth being nearly between the two bodies) that its distance from the sun must be equal to the earth's distance (ninety-two and a half million miles) with the comet's distance from the earth added, whatever that may be, so that its distance from the sun must be very great.

It is, or was when discovered, apparently on the border land between brightness and faintness as applied to a telescopic comet. Its great apparent magnitude may be owing to proximity to the earth, but if, as is probable, it is at a very great distance from us, its real magnitude must be enormous.

As soon as the moon withdraws, observations of a reliable character will be made by such astronomers as have a clear sky, when the elements of its orbit will be approximately determined, and its magnitude, distance from both earth and sun, and many other interesting facts ascertained.

It is greatly to be hoped that it prove a bright one, that it may be satisfactorily subjected to spectroscopic analysis, for no large and bright comet has appeared since the invention of the spectroscope.

Whether science will be benefited or not, my pocket has been, for Mr. Warner, who is building for my use the "Warner Observatory," probably the finest private observatory in the world, has just handed me a check for $500 for discovering it. This munificent gift, together with the gold medal I shall get from the Imperial Academy of Sciences of Vienna, makes it a comet which has some remunerative qualities about it which can be seen with the naked eye. During the whole history of astronomy, I think this is the highest price ever paid for a comet.

LEWIS SWIFT.

Rochester, N. Y., October 16, 1880.

Importance of Scientific Research.

The Philadelphia *Ledger* thinks that the scientists employed by the government have generally given a full return for the money expended upon them and their labors, and if Professor Riley has really found a means of putting an end to the ravages of the cotton worm, the editor adds, he will have paid in a single season for a whole decade of accumulated salary. So many scientists of our day turn speculative philosophers, and confound the public mind at least as to what is known and what is simply guessed at, that science, so far as they may represent it, is brought into disrepute, but the labors of real observers and experimentalists continue to be of immeasurable value to workers everywhere and in all kinds of occupations. The economic work of topographical and geological surveyors, of entomologists and meteorologists cannot be done effectively by private institutions or by individuals. The government must look to it "for the general welfare," and there is no danger that too much of it will be done. The discovery of a means of stopping the ravages of a single pest like the grasshopper, or the army or cotton worm, or the potato bug, is worth more than has been expended by the government on purely scientific labors since the foundation of the government.

The Keeley Run Colliery Fire.

The failure of the attempt to stop the fire in the Keeley Run Colliery, Pennsylvania, by flooding the mine, was noticed some months ago. The attempt to suppress the fire by means of carbonic acid gas and nitrogen has been equally unsuccessful. That part of the mine in which the fire is has been closed up, and is estimated to have a capacity of 12,000,000 cubic feet. It is claimed that 6,000,000 cubic feet of gas has been forced into the mine daily for some weeks, but it has had no effect upon the fire.

Cresolene for Epizooty.

The following experiment in the treatment of a case of epizooty is reported to the *Tribune* by George Shepard Page, of Stanley, N. J. An ordinary stall containing a sick horse was lined and inclosed with sheets of carbolized paper. A vaporizer was set in operation, evaporating chemically pure cresolene ($O_6H_5CH_3O$). The horse had been coughing very frequently, the offensive discharge from the nostrils was profuse, and the eyes were dull and sunken. In ten minutes the inclosed space was charged with the vapor. In half an hour a copious discharge of mucus took place. The animal exhibited evident relief, holding its nose over the grating through which the vapor was issuing, the vaporizer being placed in the iron feed box, over which a perforated grating was arranged. He remained in the inclosure for six hours. The effect produced was marvelous. The cough ceased, the discharge from the nostrils was entirely checked, and the eyes regained their normal condition of brightness.

INCENDIARY SILKS.

Our readers will recall the interest that was awakened some months ago with regard to the spontaneous combustion of certain silks on shipboard and in warehouses in this city. The burning of the storage warehouse in Leroy street, apparently from this cause, led to the appointment of a committee of investigation by the New York Board of Fire Underwriters. They have now completed their inquiries and issued their report, which conclusively establishes the fact that the fire in question and other fires in the same warehouse and elsewhere must have been caused by the spontaneous combustion of black silk yarn, thread, or twist, a class of fabrics often so loaded with dangerous dye-stuffs as to be at all times liable to burn of themselves. Five fires—four in this city and one in Philadelphia—are proved to have this origin, involving heavy losses and the peril of property valued at hundreds of thousands of dollars.

The evidence collected includes chemical analyses and the opinions of scientific experts, as well as the direct testimony of witnesses to the effect that in many if not all the cases examined the fires originated *within* the packages of incendiary silk. The committee refer also to fires occurring while packages of weighted silk were being transported by rail or water—for example, that of the Mosel in mid-ocean a year ago, which fire began in and was confined to cases of heavy sewing silk so stored that fire could not have taken from without.

All this merely confirms the information long since brought out abroad in consequence of fires unmistakably traced to weighted silks. It was found that certain European silk manufacturers were able to "load" silk in dyeing to such an extent that the product would yield by analysis three or four pounds of chemicals for every pound of pure silk; and yet the thread would show no visible signs of adulteration. The animal, vegetable, and mineral substances thus united with the silk fiber forms a very unstable compound, liable to rapid oxidation with a consequent heating, which under favorable conditions results in active combustion or fire. Such goods have been known to smoulder and take fire not only while closely packed in cases, but also when lying in piles upon shelves freely exposed to the air; and so dangerous are they that certain European railways have been compelled to forbid their being carried as freight. Reporting upon the fire in the Leroy street warehouse, Fire Marshal Sheldon had no hesitation in pronouncing it due to spontaneous combustion of the silk twist therein stored, and he frankly suggested that the Board of Underwriters should take steps to prevent the storage of such materials in bonded warehouses within the city limits. The matter is evidently one that importers and dealers in silks will do well to consider carefully. The profits on weighted silks may be very large, but they will hardly justify the handling of them at the risk of burning one's entire establishment.

It would seem that nations prefer not their own thermometers, but other people's. It was Germany that invented the Fahrenheit scale, which we have appropriated, the Fatherland itself preferring to employ that of a Frenchman, Réaumur; while France will have none of Réaumur, but uses the Celsius or Centigrade, whose introduction is due to a Swede.

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AMERICAN INDUSTRIES.—No. 59.

THE MANUFACTURE OF STANDARD SCALES.

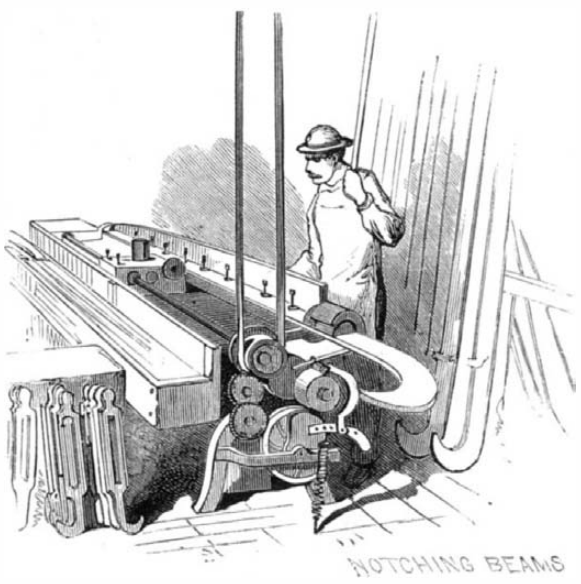
When Thaddeus Fairbanks, in 1830, made the first application of his compound lever system in the construction of weighing apparatus, its simplicity and practical usefulness were not long in being appreciated. There was nothing essentially new, however, in the theory of their construction, except in the business-like perception with which he saw how previous well known mathematical and mechanical laws might be applied, in the combination of levers and fulcra, to fill a wide field of usefulness. Archimedes, more than 200 years before Christ, had shown a knowledge of the capabilities of the lever which has been nowhere better illustrated than in the saying imputed to him, "Give me a fulcrum on which to rest, and I will move the earth;" but the only application of the principle of the lever in this department previous to 1830 was in the old-fashioned steelyard, practically very limited in capacity, and exceedingly clumsy in operation. These steelyards and even-balance scales were then the only weighing machines in general use, and it was the obvious need of an improvement in this direction, first experienced in his own business, that led Mr. Fairbanks at the outset to make a scale for his own use, then to make others for his neighbors, and finally, with his brothers Erastus and Joseph, to make a business of this manufacture. The business in 1830 was conducted in a building 25 by 60 feet, employing 10 men. To what extent it has grown within a half century is much better set forth in the illustrations we to-day present relative to this industry than can be understood by the mere details in figures. Ten substantial brick buildings, with nearly ten acres of floor room, now take the place of the original shop; there is also a lumber yard covering ten acres, in which are constantly kept from two to three million feet of lumber; there are over 600 men employed, and 93 tenement houses for the employes; the capital invested now amounts to over $2,000,000, and the annual product to considerably more than that, while in 1831 it was less than $6,000.

As E. & T. Fairbanks & Co. cover all departments of the work which enters into their scales, their foundry is necessarily one of the principal buildings. It is 110 feet wide by 175 feet long, with a side extension, in which are three furnaces, one of 20 tons capacity, the others of 12 tons each; also a Sturtevant blower and a 35 horse power engine. These furnaces are worked alternately, one in the morning, a second in the afternoon, and the third on the following morning, their charges being always put in by weight, from the furnace charging scale perfected by the company. These scales are built of iron, so as not to be affected by the heat, and are so arranged that the weight of each portion of a charge may be exactly known without the knowledge of the workman. The pig iron used is about three-fourths American and one-fourth Scotch. The castings embrace a wide variety of sizes, from the large levers and framework of the great canal weigh lock and railway scales down to the small balances and tiny weights everywhere seen. A fine moulding sand is obtained near by, at Fort Ann, near Lake Champlain, and 500 tons of it come every year to the foundry. A railway track runs through the foundry, and all of each day's castings are loaded on cars and run to the "pickling" and milling room, where the larger pieces have a bath in a weak solution of sulphuric acid, and the smaller ones are revolved in a drum according to the usual plan with small castings. Should any imperfect pieces be found here they are sent back to the foundry, and, if the fault be plainly due to careless or negligent workmanship, the workman is held accountable therefor. There is usually but little cause for complaint on this score, however, for the workmen have generally been many years in the employ of the company, and their theory in this, as in every other department of their business, has been to employ only the most competent and skillful hands to be had.

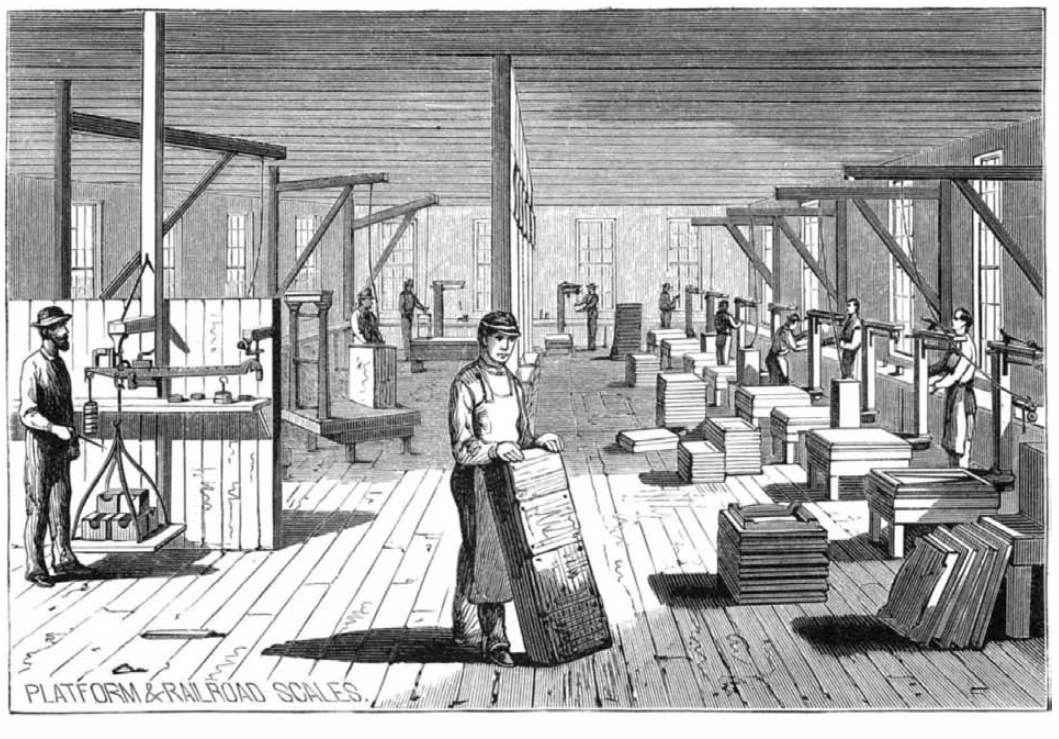
In addition to the business done in this foundry there is a separate department for the brass castings, in which about 1,000 pounds are melted in the crucibles daily. Lake Superior copper is principally used, together with old brass, brass filings, etc., nothing being allowed to go to waste, but especial care is taken in tempering and in the alloy for the brass scale beams, so that the notches will remain sharp and not wear off.

The pattern department occupies a building by itself, 32 by 80 feet, and two stories high. It is crowded with models for castings, which are stored here when not in use, some of the patterns dating back more than forty years, and affording, by contrast with those now employed, a striking record of the progress which has been made in the furnishing of lighter, more convenient, and elegant scales than were known in the early history of the business. On the lower floor are the large scale patterns, including those for the great iron levers used in canal weigh locks, some of which weigh 1,650 pounds each, while eight of them are required for each scale. Here also are the great patterns for railway scales of 150 tons capacity, but which can be increased indefinitely by adding to the number of sections. The second story is also crowded with patterns in shelves and trunks, for the firm are now making over 800 different styles or modifications of scales, some of the patterns for which take a good many pieces. The making of new patterns, however, goes on as regularly as though all this vast plant had not been accumulated. A draughting room is connected with the pattern shop, and here are constantly being made designs for scales of novel construction to meet new uses, to obviate some engineering difficulty, or to more completely serve their purpose than those already introduced. The drawings here show designs for railway scales for tracks of all widths from 30 inches to 7 feet; for railway suspension scales, in which the great levers are in a framework high enough for a locomotive to pass under them; for combination beams for mines; different devices for measuring grain, for testing machines, etc. Of the latter class of machines the largest the firm has made was for the city of New York, being of 108 tons capacity, to be used to test the strength of girders and building materials. The blacksmithing and forging department has a special building for itself, 200 feet long, in which 75 workmen are employed. It is provided with large and small power hammers, and dies for such portion of the work as can be struck out. The bar iron consumed yearly amounts to 350 tons, besides 50 tons of steel and 20 tons of nuts and washers.

The machine shop is 180 feet long by 70 wide, and is fitted up with a great variety of costly machinery, a large portion of which has been especially designed for the scale manufacture. In all parts of the works there are over 1,600 feet of main shafting, besides counter-shafting, etc., and it requires more than six miles of steam and gas pipes to do the heating and lighting. Perhaps the most interesting machinery in this department is that for making the notches in the scale beams. This operation for all the small scale beams is done on two or three hundred at once the beams being laid in a frame which travels backward and forward under a cutter until all the notches are made, and this is done so nicely that the edges are all left smooth, each beam being necessarily notched in perfect line with all the others, and thus, with the machine set carefully at the commencement, insuring entire accuracy. The large beams are cut by a heavier machine with a different movement. The marks on the sides of the beams are cut with a knife worked by a geared feeding arrangement, but the figures are stamped on by hand. The making of the scale pivots and loops with the requisite finish and temper is one of the most important portions of the work in the machine shop, for on the finish depends, in a great degree, the sensitiveness of the scales, as to the temper is to be attributed much of their good wearing qualities. The company use only direct line levers in all their machines, with devices to prevent strain from torsion, adopting clevises and links in hanging main levers. Their pivots are made from sections of steel rods, one edge being cut down smooth and true to the sharpness of a knife by a machine designed for this purpose. These pivot edges are cut and recut, gauged, and made smooth with the utmost care, and the loops on which they are to bear are lined with steel, made true and smooth. Both pivots and loops are then hardened by a process for which the company has obtained a patent, and which they claim will give the hardness of the best refined steel with the toughness of iron.



Notwithstanding the care, however, which is taken in all the previous parts of the work it is not until both scales and weights have passed the testing room that they are considered ready for shipment. Here may be found, in safes provided therefor, standards of the weights of nearly every country in the world, a part of the machinery of weighing which was perfected long before we had any such thing as "standard" scales for general use. All the scales and weights which go out of the establishment must first be proved by these standards; if the weights are too heavy a shaving must be taken off by the rimmer, or if too light a little more metal must be added, while the scales must be equally true and positive, no matter what portion of the platform the load be placed upon. It often happens, therefore, with the great care which has been taken in every detail in order to secure the most perfect work, that a scale intended to weigh several thousand pounds does not show a variation of an ounce, and will be so sensitive that this weight will move the beam.



The japanning, painting, and ornamenting, which constitute

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no small proportion of the work on small scales, each give employment here to a good many hands, although every facility has been provided to favor the work in these departments. The pieces of scales and weights to be japanned are piled on cars which run on tracks leading into huge ovens, thereby necessitating as little handling as possible. Some of the bronze ornaments are put on with powder, with rubber stamps and size, and others, as well as painted devices of various patterns, are transferred to the various parts by the decalcomanie process.

The tin shop, where also the sheet copper and brass are worked up into the different kinds of scoops and receivers, is provided with all the appurtenances which the inventions of the past few years have brought so prominently forward in this business. In this department 300 boxes of tin plate and 10 tons of sheet brass and copper are used annually.

The carpenter and joiner shop forms a large and important branch of the business; for here are made not only the woodwork of the scales, but the packing boxes in which they are shipped. Only the best seasoned wood is used in the scales, and to obtain a proper choice for this purpose from one to two million feet are always kept on hand. The company own large tracts of timber land convenient to their factory, and receive from their own sawmill over a million feet annually. Their platform scales with hard wood platforms have been decidedly preferred to other patterns with iron platforms, horses not being so likely to slip on them, and when the platform is worn or broken it can be easily repaired.

Of the large number of patents issued to the company for improvements made at their establishment in the scale manufacture over thirty are still in force, although the original invention on which the first Fairbanks patent was granted was made in 1830. Among the most important of their present patents are those on machines for milling knife edges, for weighing and distributing scales, for electro-magnetic weighing machines, automatic grain scales, track scales, registering and recording beams, letter balances, etc. They do not, however, lay so much stress on the value of their patent rights as they do on the perfect work they have always made it the rule of their establishment to turn out, to which end their long experience and ample capital are especially directed. Both at home and in foreign markets they have met with competition from cheap scales, but they hold, as they originally won, their position as the largest manufacturers of scales in the world by steadily adhering to the policy on which the business was commenced, of sending out only the best goods. Their exports include shipments to nearly every country on the globe, the weights and scales being often so provided as to give readings in two or three different languages, many of those now sent abroad being fitted up for weighing according to the French metric scale as well as that called for by the particular usage of the country where they are sent.

It has often been matter of comment that so large a manufacturing business has been thus successfully developed so far inland, away from water communication with other localities; but the explanation is readily found in the fact that the place has grown up with the industry, and now affords the large number of trained mechanics, drilled in this especial branch of business, without which it would be impossible to make it a success. The firm, while adhering strictly to the best business principles, have always been liberal with their workmen, anxious to promote faithful and skilled hands, and pensioning those who have become superannuated, so that, instead of having been troubled with strikes and disputes about wages, its members are regarded by their employes with more of that friendly feeling so often found in France and a few other localities in Europe, but which is seldom seen in so marked a degree here. With the growth of the town, too, have come the most liberal railroad facilities, so that, from tracks which run into the works, supplies may be received and goods shipped direct on trunk lines running to all points of the compass. A large proportion of the employes own their own houses, and different members of the firm have built and endowed various institutions for the benefit of the community in which their business has grown up, among which are a library, art gallery, lecture hall, and an academy.

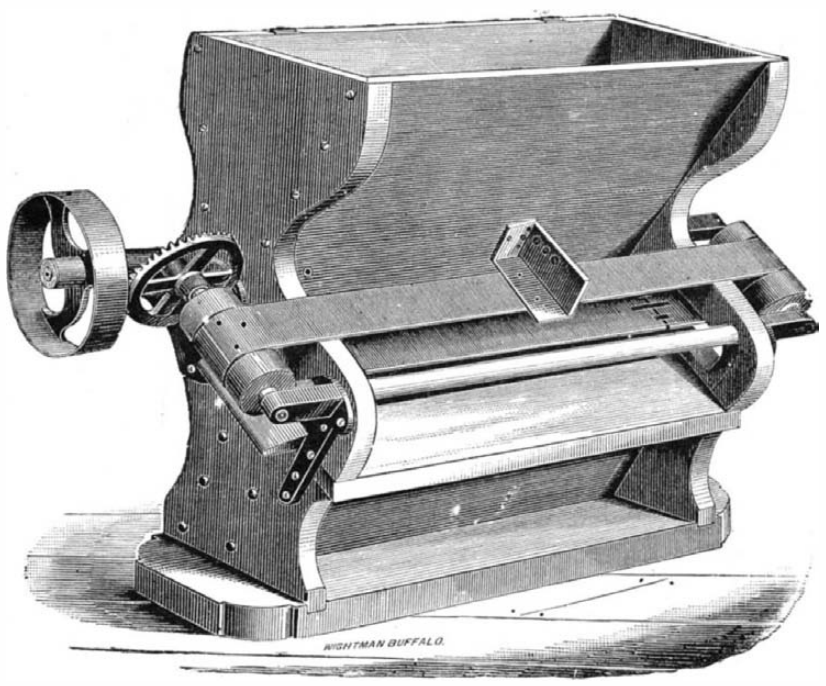
The New York office of the firm is at No. 311 Broadway, but they have besides this fifteen other warehouses in different parts of the country, and established agencies in every quarter of the globe.

Repelling Flies.

I manage to keep flies out of my stable by removing the droppings several times a day, and sprinkling very slightly the floor of the stable with kerosene. I have a tin can with a cork in it, through which is pierced a small hole; through this I drop the kerosene. A pint will last over a week, and seems to be quite objectionable to flies of all kinds.—*Wm. Horne, V. S., in Country Gentleman.*

THE MAGNETIC SEPARATOR.

The engraving shows a magnetic separator for automatically removing metallic substances from grain. As the harvesting and thrashing of all kinds of grain are now done almost exclusively by machinery, and since the introduction of wire-binding attachments to the reaper, magnets in some form for removing pieces of wire and other metallic substances from the thrashed grain have become an absolute necessity. Heretofore gang magnets, placed in spouts through which the grain flows, have been used. With this method, however, after a certain amount of metal has been collected by the magnets, it is necessary to remove them and brush it off by hand, and unless the flow of wheat is stopped the material to be taken out passes on with the grain. If the magnets are left too long in the spouts without being cleaned, the metallic material is carried by with the grain, and the consequence is that more or less of the material sought to be removed is left in the grain.



MAGNETIC SEPARATOR.

The engraving shows a machine which does this work effectually as well as automatically. The grain is fed into the hopper, from which it passes over a zinc plate the entire width of the machine. As this zinc plate is placed on poles of magnets, any metallic substance in passing with the grain over the magnets is held by the attractive force of the magnets until removed by the wiper, which, being attached to an endless belt, passes once a minute over the magnetic field, carrying off the metallic substances, depositing them in a box at the side of the machine. This process relieves the miller from care, and prevents metallic substances from going with the grain to the burrs or rolls as the case may be, unless introduced after it has passed the machine. To prevent this, the separator should be placed as near the burrs or rolls as circumstances will admit.

For further information address Messrs. Howes, Babcock & Ewell, manufacturers, Silver Creek, Chautauqua Co., N. Y.

A NEW BOILER CLEANER.

The device represented in the accompanying engraving is designed to prevent the incrustation of steam boilers by removing all the scale-forming matter contained by the water used in them, whether vegetable or other matter in suspension, or salts in solution. The simplicity of the principles upon which the action of this ingenious invention depends, and their entire accord with natural laws, commands the approval of all practical engineers. The problem of preventing incrustation in steam boilers has proved to be one of the most difficult ones in the whole range of engineering science.

Millions of tons of coal have been wasted, vast amounts of property destroyed, and thousands of valuable lives sacrificed to the evil which this device, it is claimed, effectually removes. The most careful consideration has been given to this subject by scientific men, mainly in the direction of chemical analysis. How to render the solid sulphates, carbonates, and chlorides more soluble, and thus enable engineers to relieve their boilers by frequent blowing, has been the inquiry. But the results of these investigations have been only partially successful, and the owners of steam boilers have found only too often that the remedy proved worse than the disease.

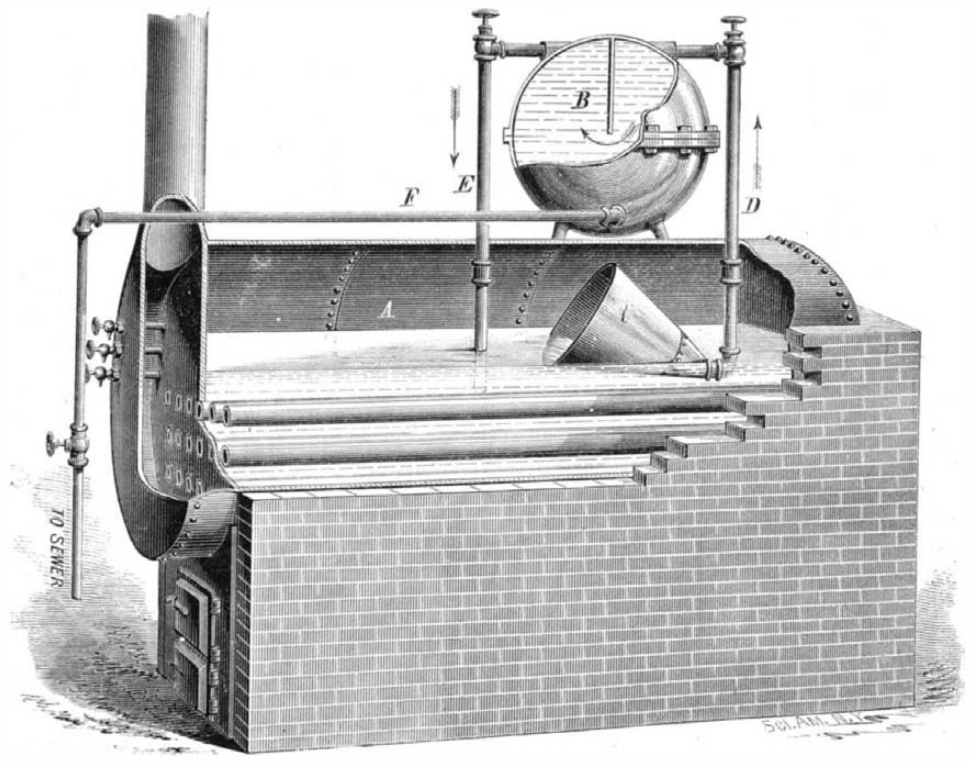
Many mechanical devices have also been tried in this and other countries, but these have been crude and complicated, involving much trouble in manipulating them, and were finally discontinued.

The invention which we illustrate seems to mark a new era in the treatment of this subject. Since its first introduction, in 1876, it has been steadily growing into public favor, until it has secured the unqualified approval of many of the most practical and scientific mechanical engineers in this country.

The proprietor, Mr. James F. Hotchkiss, by a series of experiments and improvements, has reduced the question of the removal of sediment from, and the prevention of incrustation in, steam boilers to a certainty, and over six hundred times has this fact been demonstrated by trials in every part of the country and with all kinds of water.

The engraving represents the cleaner as attached to any ordinary boiler. The large iron bell mouth, C, is placed near the tubes or flues so as to bring the bottom of the mouth on a line with the lower gauge cock (low water). This mouth is usually connected by a right and left nipple and elbow to the vertical up-flow pipe, D, piercing the shell as far back as braces will allow, and connecting with one side of the improved reservoir, B, at the top. From the opposite side of the reservoir a return pipe, E, extends to a cooler stratum of water as near the bottom of the boiler as the tubes or flues will allow, the lower the better.

This system of pipes forms a siphon, which, together with the difference in temperature between the surface and the point where the water returns to the boiler, causes a constant circulation of water as long as any steam remains in the boiler. In all boilers heated at one of their extremities there is established a circular motion of the water, which not only raises the solid bodies and agitates them, but also keeps them in constant motion in such a way that the surface currents always set back from the fire, while those at the bottom travel in the opposite direction, so that all matters contained in the water, whether originally held in suspension or precipitated from solution, are carried by ebullition to the surface, and there float until they are finally deposited upon the heating surfaces, and attach themselves in the form of scale, and this continues until the accumulations cause a great increase in the amount of fuel required for evaporation and incur the danger of explosion from overheated plates.



THE HOTCHKISS BOILER CLEANER

The Hotchkiss mechanical boiler cleaner affords a complete remedy for these evils by removing all sediment as soon as it rises to the surface. As the suspended matters are thrown upward by ebullition the surface current carries them toward and into the large mouth-piece, whence they are carried by the circulation to the reservoir, where, the water being cooler and in a quiescent state, all solids are precipitated. The solid matter may be blown out from time to time through a blow-off pipe, F, provided for that purpose. The spherical form of the reservoir permits of blowing out the mud which accumulates in it, without wasting the water.

Although the general principle of this invention has not been changed, it has been greatly improved in detail, and cheapened and simplified, so that it may be readily applied to any boiler by an engineer or ordinary mechanic.

Further information in regard to this invention may be obtained by addressing Mr. James F. Hotchkiss, 84 John street, New York city.

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MECHANICAL INVENTIONS.

Mr. Robert P. Dake, of Colby, Wis., has patented a hand power for driving light machinery, such as straw cutters, pumps, churns, grindstones, sawing machines, lathes, boats, and other light machines where other power is not attainable.

Mr. James B. Carlin, of Carthage, Mo., has patented a grain mill for grinding corn, oats, and other grains for feed for stock, and for other purposes where a coarse meal is required.

Mr. Benjamin C. Senton, of Whitehall, N. Y., has patented a propelling device especially adapted for propelling vessels in shallow waters and canals. The invention consists in reversing mechanism by which the paddle shaft may be turned, so that the paddles reverse their action.

Mr. John F. Mathews, of Stamford, Conn., has patented an improved dumping car for coal and other substances, so constructed that it can be dumped with ease and certainty, and readily readjusted to receive another load.

NEW PROTECTIVE SUIT FOR FIREMEN.

Several years ago a fireman's suit, invented by Oestberg, a Swede, was the object of considerable attention. It was made of felt, which was continually soaked with water, thus protecting the wearer from the effects of the flames and heat. The wearer was protected from suffocation by a supply of fresh air conducted to him through a flexible tube connected with an air pump.

The disadvantage of this suit was that the water and air had to be conducted to it through flexible tubes, and if the wearer was compelled to operate some distance from the pumps the dangers arising from entanglement or rupture of the tubes was so great as to render the apparatus impracticable in the majority of cases.

Mr. August Beyer, of New York city, recently obtained a patent for an improved fireman's suit, which is devoid of the imperfections of Oestberg's device. His suit is made of some thick fabric, serving as a nonconductor of heat, and has a lining of oil cloth, which is covered on the inner side with a layer of compressed wool impregnated with coal dust, mineral wool, or like material, and is protected on the outer side by a thick woolen fabric having a thick coating of a mixture of red ocher, glue, and sulphur. The metal helmet has a projecting part with a thick bullseye glass in front; from this projection a flexible tube, resembling an elephant's trunk, hangs down. The lower end of this trunk is provided with a perforated plate, which retains a quantity of small pieces of sponge, that cool the air as it passes through them and frees it from smoke. A spiral spring gives the trunk the required strength and prevents it from collapsing. A collar is attached to the bottom of the helmet, as is shown in dotted lines, and serves to connect the jacket and the helmet.

The heat of the fire evaporates the moisture of the wool in the inner lining and thus cools the body. The outer coating of the suit is fire and water proof, and blisters under the effects of the heat, but protects the inner layers.

The fresh coat of the ocher, glue, and sulphur paint is applied to the suit after use. A fireman provided with one of these suits can enter into the midst of the fire without suffering from the effects of the heat or smoke.

This device will be of great service in hotels and public buildings, and it is very valuable for private use, enabling its possessor to escape from a burning building in cases where it would otherwise be impossible. The inventor informs us that it has been subjected to severe tests and has proved efficient in every case.

Further information may be obtained by addressing the inventor, Mr. Aug. Beyer, 149 Avenue B, New York city.

BEYER'S PROTECTIVE SUIT FOR FIREMEN.

A Blind Man Climbs Mont Blanc.

That a blind man should undertake to climb the highest peak in Europe would seem at first sight to be about as useless and foolhardy an undertaking as could well be conceived. It appears, however, from the mountain climber's own account to have been a fair climb, pluckily undertaken and manfully carried out for a reasonable purpose. The climber, Mr. F. J. Campbell, of the Royal Normal College for the Blind, has devoted his life to the elevation of the condition of his sightless countrymen, and he finds that in order to carry on his work it is necessary to keep up his pluck, energy, and determination by all sorts of athletic efforts. Skating, swimming, rowing, riding, have contributed their share to this end, and last year he went to Switzerland to try mountain climbing. He went again this year, ending with the ascent of Mont Blanc, a task that taxes the capacity and all the powers of those who have no lack of human faculties and can enjoy by sight the grand views which the mountain summit offers as a reward for the hazardous undertaking.

Practical Suggestions on Stuffing.

If hair is confined, and the curl taken out of it by the use of the stuffing stick or wire, it has no power to act, as curled hair is intended to do; the life is twisted out of it with the stuffing stick; it lies dead, and we have to keep pushing more in to fill up the space between the tufts, so when the square or diamond is finished, it contains one-third more hair than it would if the stuffing stick had not been used. The job also is lumpy and heavy, and in a short time the cloth becomes loose by the settling of the hair, for the power to act has been taken out of it. If the tuft cords were cut and the cloth removed, the little ball of hair would scatter over the bench like so many walnuts. Now, if the hair had been laid, and the cloth tufted down through it, it would not do this, for the hair would be just as lively as when taken from the bag. We here give two practical ways to stuff a cushion.

A good cushion can be stuffed up in this way: Make the top up on a frame—lay the hair—and in sewing it to the facings, leave the back part open from corner to corner. Take sheeting or muslin, and make a pad one inch larger all round than the cushion facing and one inch thicker; fill the pad full of good hair—not with the stuffing stick, but with the hand—in the same manner that a mattress is filled; sew up the mouth, and quilt edge, bottom, and top, and also through the middle, with coarse shoe thread; fasten the cushion on the bench and fill the two front corners with cotton, and force the pad into the cushion. If not full enough, lay hair on top of the pad, and while sewing the mouth up, lay a little hair between the pad and facing; draw in tufts level with the top of facing. A cushion stuffed in this way must be comfortable to sit on, and it will keep its shape if the pad is properly filled and quilted; all with no thanks to our venerable stuffing stick.

Another way, and one that is quick for stuffing a cushion, is: Make the cushion with plain top, and when ready to stuff, fasten it on the bench, leaving mouth large enough to get the arm in. Commence filling the top first, using the hand. When a few layers are in, go to the bottom and fill that in the same way, but keep the top stuffing ahead. Continue this until the cushion is filled. It may be that the stuffing wire will be needed at the back corners, but only there. This is a much quicker and smoother way of filling a cushion than the old method.—*The Carriage Monthly.*

The Oregon Salmon Fisheries.

From the annual report of the Oregon Board of Trade we learn that the salmon catch of the past spring and summer has exceeded anticipations, yielding 530,000 cases. In 1875 a catch of 231,500 cases was considered enormous; 1877 yielded 400,000 cases, and 1879 as many as 435,000 cases. This rapid increase shows the vast extent and financial value of the Oregon salmon fisheries. Of the half million and more cases packed this year, 211,522 cases were sent to San Francisco, and 239,241 cases were shipped direct to Great Britain.

Growth of Inventions.

"Confound those ancients, they always get hold of one's best ideas." As it has been found in literature so in science, and the disappointed inventor, tumbling for the twentieth time over an anticipation of his cherished scheme, is tempted to redeclare that there is "nothing new under the sun," and that all is vanity and vexation of spirit. We give a few interesting examples of clear theoretical, if unpracticable, anticipations of a notable modern discovery.

Professor Stanley Jevons, ten years ago, found allusions to a magnetic telegraph running through many scientific or quasi-scientific works of the sixteenth and seventeeth centuries. The poet Addison speaks of "a chimerical correspondence between two friends by the help of a loadstone." Sir Thomas Browne, in his "Pseudodoxia Epidemica," says: "The conceit is excellent, and if the effect would follow, somewhat divine;" and he speaks of it as a conceit "whispered thorow the world with some attention, credulous and vulgar auditors readily believing it, and more judicious and distinctive heads not altogether rejecting it." Sir Thomas, it would seem, submitted the matter to experiment, but found that although the needles were separated but half a span, when one was moved the other would stand like Hercules' pillars. Joseph Granville, in his "Scepsis Scientifica" (1665), discusses the objections of Sir Thomas Browne, and concludes that "there are some hints in natural operation that give us probability that is feasible." Glanvill, more than 200 years ago, said: "Though this pretty contrivance possibly may not yet answer the expectation of inquisitive experiment, yet 'tis no despicable item that by some other such way of magnetic efficiency it may hereafter with success be attempted, when magical history shall be enlarged by riper inspections; and 'tis not unlikely but that present discoveries might be improved to the performance." The earliest book in which Mr. Jevons found allusions to a magnetic telegraph is the "Natural Magic" of Baptista Porta, published in 1589. In the seventh book he describes the "wonders of the magnet," saying in the preface, "I do not fear that with a long absent friend, even though he be confined by prison walls, we can communicate what we wish by means of two compass needles circumscribed with an alphabet." In the eighteenth chapter of the same book he describes the experiment of putting a magnet under a table, and moving thereby a needle above the table. This experiment, as Porta remarks, was known to St. Augustine, and an exact description will be found in his "De Civitate Dei," a work believed to have been begun A.D. 413. It seems probable that this passage in St. Augustine suggested the notion either to Porta, Bembo, or some early Italian writer, and that thus it came to be, as Sir Thomas Browne says, "whispered thorow the world." Mr. William E. A. Axon refers to the passage in Strada, in which he supposes the loadstone to have such virtue that "if two needles be touched with it, and then balanced on separate pivots, and the one be turned in a particular direction, the other will sympathetically move parallel to it. He then directs each of these needles to be poised and mounted on a dial having the letters of the alphabet arranged around it. Accordingly, if one person has one of the dials, and another the other, by a little prearrangement as to details, a correspondence can be maintained between them at any distance by simply pointing the needles to the letters of the required words."—*Design and Work.*

An Automatic Fire Extinguisher.

An engineer in the Brooklyn Fire Department has invented an automatic fire extinguisher, which was recently tested as follows: An experimental shed was half filled with barrels of shavings and chips. Near the roof was an iron pipe for the conveyance of water, to the end of which was attached a bulb perforated with numerous holes. In the center of the bulb was a cartridge, held in position inside a plug, to prevent the water from flowing, and on the outer side was a telegraphic attachment. The inflammable material having been lighted, in thirty-five seconds the fuse of the cartridge became ignited, resulting in the explosion of the cartridge. This released the plug in the bulb, allowing the water free course, and at the same time released the telegraphic attachment and sounded an alarm on an instrument at a distance. The experiment was in every way satisfactory, as the fire was extinguished without damage to the shed.

The Baking Powder Controversy.

Shortly after the publication in this paper of the valuable report on alum in baking powders, by Dr. Henry A. Mott, Jr., a bitter attack upon Dr. Mott's professional character was made by the editor of the *Spice Mill.* Suit for damages for libel was brought by Dr. Mott, in the Superior Court of this city, and a verdict in his favor was given October 16. The damages awarded were $8,000, to which the court added an allowance of $150.

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Improvements in Fire Hose.

In nothing connected with the fire service has there been greater improvement during the past ten years than in the manufacture of fire hose. In the old days of hand engines, there was scarcely anything but leather hose used. Occasionally a department would buy sewed canvas or linen hose, but nearly all those used was made of leather. With the advent of the steam engine and higher water pressures, came a demand for hose of greater strength than leather. Out of this demand grew rubber hose, which is made of cotton fabric, coated with rubber. By using several plies of cotton, hose of sufficient strength was obtained. Then some one conceived the idea of dispensing with the rubber, and making fire hose entirely of cotton, woven in a cylindrical form, having no seam, either sewed or riveted. The old leather hose was equal to the pressure obtained with hand engines, but, when new, the manufacturers would not guarantee it to stand 200 pounds pressure, and by constant use its power of resistance rapidly decreased. The rubber and cotton hose now made for fire service is usually warranted to stand a pressure of 400 pounds, and is guaranteed to last three years. Often the water pressure at tests is run up much beyond 400 pounds, and the term of serviceability far exceeds the guarantee. We have seen sewed cotton hose now in service that was purchased twenty years ago, and rubber hose that has seen over ten years' service, and is still in use. But it is not the capacity to resist pressure that is evidence of enduring quality. Hose may be constructed to resist 700 or 800 pounds pressure, yet be so deficient in wearing surface as to last but a short time. What is required in hose is lightness, strength, and durabilty. Hose that will stand a pressure of 200 pounds, having a surface that is well protected and durable, is better than hose that will stand 700 pounds pressure, yet having a surface that is not likely to resist the wear and tear of street service.

Few persons comparatively have an adequate idea of what it has cost manufacturers to bring the construction of hose to its present point of perfection. We were recently shown a piece of cotton hose about one foot long, woven cylindrical, which, we were informed, had cost $15,000. That is to say, an inventor had spent years of his time and the sum named in perfecting a loom that would weave cylindrical seamless fabric suitable for fire hose. When he had produced the piece alluded to, he discovered that it would not do, but he had found the right way to do it at last, and his time and money had not been wasted. Many thousands of dollars have been expended in perfecting rubber hose and the machinery for its production. The manufacture of fire hose now constitutes an important American industry, requiring millions of dollars to conduct it, and giving employment to thousands of persons. It is an industry that is not adequately appreciated, even by those identified with the fire service. Firemen are wont to regard their apparatus with feelings of pride, and to boast of the achievements of their engines, while scarcely giving a thought to the hose, without which the engine would be valueless. Hose is not only a necessary part of the equipment of a fire department, but is usually the most costly. A steam fire engine will last for fifteen or twenty years, or longer, if carefully cared for, while hose necessarily wears out. The purchase of new hose year by year soon involves a city in an expenditure greater than the cost of apparatus. It is safe to say that if the hose in use in the fire service receives as good care as the apparatus, it would last much longer than it does. But the fact is, hose is regarded as rather an insignificant article: very necessary at a fire, but scarcely worth caring for afterwards. Even at a fire, it is generally treated with great roughness, trampled on by men and horses, and driven over by wagons and apparatus, and kicked about in a reckless manner. It is an easy matter to injure hose when under pressure, filled with flowing water, and strained to its full capacity. A slight blow will sometimes make an abrasion that results in a leak and a burst, destroying a length of hose worth in the neighborhood of $50. A little care and thoughtfulness on the part of the firemen would prevent such accidents. After hose has been used, it should be carefully dried and cleaned. To dry it, the best way is to suspend it at full length in a tower. It should *never* be hung up by the middle, as is too often done. Where it is bent over and allowed to hang, it is apt to develop a weakness afterward. Leather hose should be cared for as carefully as rubber, cotton, or linen. It is a common remark that leather hose requires no care. While it is true that leather hose will stand neglect better than any other kind, it is also true that it will repay care and attention quite as well as any other.

While there is a great diversity of opinion as to which hose is the best, and leather, rubber, cotton, and linen each has its champions, we, certainly, shall not extol one above another. Each has its place, and each has made a record for itself. Our purpose is to call the attention of officers of fire departments to the necessity of taking the best of care of their hose. First, always buy the best; examine and test all kinds, and, having decided which kind is best suited to your requirements, purchase the best quality of that kind that you can find; having secured your hose, take care of it as carefully as you would of a new steamer or hook and ladder truck. By so doing you will not only save yourselves much anxiety of mind when you are fighting fires, but you will save many a dollar to the taxpayers who support your departments. But, of all things, beware of cheap hose, and do not trust your reputations as firemen upon a line of hose that you have no confidence in. The bursting of hose at a fire may result in a serious calamity. If fire committees will persist in forcing cheap hose into the departments, the chief engineers should publicly protest against it and warn their fellow citizens of the danger to which they are exposed in consequence. With the abundance of good substantial hose that is now made, there is no excuse for any department being short of that article or having an inferior quality thrust upon them.—*Fireman's Journal.*

Jupiter's Satellite Seen Without a Glass.

Since the English shepherd reported to his master the curious sight wherein "a big star swallowed a little one," the larger satellites of Jupiter have more than once been seen with the unaided eye. Quite recently a lady of our acquaintance thus saw two of the great planet's moons and correctly described their positions with reference to their primary, the accuracy of the observation being verified by means of a telescope. The night was exceptionally clear, and the "seeing," as the astronomers express it, unusually good. The point of observation was near New York, and not more than two hundred feet above sea level.

At a recent meeting of the California Academy of Sciences there was read a communication from the president of the Academy, Professor George Davidson, describing what he terms an unmistakable case of seeing Jupiter's satellites with the unassisted eye, the second case which he has reported, the first being from Mount Diablo, Cal., in 1876.

Professor Davidson writes from the station Monticello, of the United States Coast and Geodetic Survey, 3,125 feet above the sea, the highest point of a sharp ridge overlooking Berryessa Valley on the west and the Sacramento Valley on the east.

He says: "For nearly a month the Sacramento and Coast Range valleys have been filled with dense smoke, and the distant mountain ranges have all been hidden. Even the bold, dark, grand mass of Mount Helena, distant but twenty-four miles, was barely visible through the thick atmosphere. The upper limit of the smoke stratum was quite sharply defined to the eastward; above it the sky was generally clear, but upon the present occasion only moderately so. The weather for some time had been warm and pleasant, without clouds or wind. On the early evening of Monday, September 20, we were looking at the obscured moon struggling through the dense smoke; Jupiter, at an estimated elevation of about 8 degrees, was emerging from it, and for an elevation of 25 to 30 degrees the whole sky was hazy, and stars of the fifth magnitude, and even some of the larger ones, were not visible to the naked eye. There was not the least radiation to Jupiter, and the planet rose through the smoky but quiet atmosphere into the thinner smoke or haze without radiant points of light to blur his appearance. With the unassisted eye Professor Davidson detected the third satellite of Jupiter, to the left and below the disk of the planet; but, lest he might be mistaken, he refrained from calling attention to it for some minutes, until there could be no possible mistake, when he announced the visibility of a satellite, but without stating its position in relation to the primary. All the officers immediately announced its visibility and position, but naturally wondered why it should be seen so unmistakably through such a thick, hazy atmosphere. A binocular, or good field glass, with magnifying power of seven diameters, revealed it, and also showed the other satellites on the side of the planet, but revealing the first and second satellites with difficulty, until the planet had risen somewhat higher. The third satellite continued visible to the naked eye for perhaps twenty minutes, when the moon rose above the smoke stratum, and the planet began to exhibit traces of radiation, when the satellite was lost to the naked eye, although all the satellites had become much brighter than before in the field of binocular. Upon subsequent nights, after the smoke had in great measure been blown away, with a remarkably clear sky and no moon, but with great radiation to the planet, no satellites have been surely made out with the unassisted vision. The observers who distinctly saw the satellites were Messrs. Lawson, Gilbert, and Buckland, and also Mrs. Davidson."

The Earth's Magnetism.

The great physical problem of terrestrial magnetism has engaged the attention of numerous physicists lately, and it is well known that several ingenious solutions of it have been propounded. Professors Ayrton and Perry, for example, conceived the happy thought that the earth was charged with static electricity, which being carried round on the surface by the diurnal rotation, acted like a circulating current and magnetized the core. A severe blow was dealt to this hypothesis, however, by the mathematical criticism of Professor Rowland, who pointed out that the surface charge required was competent to send a spark from earth to moon. A theory based upon the existence of electric currents flowing in the atmosphere around the earth was promulgated later; and now we have another supposition, which has a better claim to serious attention than any of the rest, because it is supported by direct experiment. Starting from the idea of M. Edlund that an electric current is really an ether current flowing in the circuit, and that electrostatic effects are due to rarefactions and condensations of the ether, M. Selim Lemström considered that he might produce this ether current by mechanical action. He therefore made a paper tube having two concentric walls and mounted on an axle. A core of soft white iron was placed within the tube, and on rotating the latter the core was found to be magnetic, as demonstrated by two fine astatic needles. Reversing the rotation, reversed the magnetic poles; and M. Lemström concludes that the relative motion of the ether in the revolving tube and the stationary core was the cause of the polarity. It follows that if the tube be stationary and the core revolved a similar effect will be produced; and hence if a magnetic body like the earth be rapidly rotated round its axis in an insulating medium like the air, it will exhibit magnetism. Pursuing this idea into mathematics, M. Lemström arrives at an expression for the magnetic moment of the earth which agrees very well with the formula of Gauss.

FISHING ON THE AMAZON.

Much attention has lately been given to the wonders of the great river Amazon, or "the Amazons," as the people there call it. Its whole valley abounds in streams that help to make up the entire volume of waters. These spread out into lakes, lagoons, and swamps, that extend over large regions of country. This is especially so in the rainy seasons or flood times.

The channels and lakes are abundantly supplied with fishes. Even large fishes are often left in the swamp lakes and streams when the water is low. A hundred different kinds of fish can be bought in the markets of Rio, many of which come from the Amazon.

Those most valued are *piranhas* and *pirarucus*. They are the largest, while there are numerous smaller varieties. The Indians catch the latter with hooks and lines or shoot them with arrows. But the larger fish are speared with a kind of trident. The men and even small boys acquire great skill in the use of these implements.

In the summer months the people come by hundreds to the lakes and channels to fish for the great *pirarucu*, and to prepare the fish much as codfish is prepared by the northern fishermen. Some of these fish are seven or eight feet in length. They are first dressed and cut into wide thin slices. These are well rubbed with salt and hung on poles to dry in the sun. The slices are taken under cover every night and carried out again in the morning. The stranger does not at once relish this dried fish, yet it is the standard flesh food of all the poorer classes throughout a large part of Brazil. During the fishing season the people build and live in little huts along the shores. Traders, in canoes, come with a stock of cheap wares to barter for the fish. Thus a trading community is formed, which breaks up with the January floods. The *piranhas* are much prized and are easily caught, for they are greedy to bite at most anything, from a bit of salt meat to a bather's toe. Boys thrash the water with poles to attract these fishes.

The Tupi word *piranha* is a contraction of *pira sainha*, meaning "toothed fish." The same word is used by the Indians to describe a pair of scissors. There are several species of these savage *piranhas*, some being more than two feet long. They make nothing of biting an ounce or so of flesh from a man's leg. People are sometimes killed by them. Hence Brazilians are shy of going into these lakes and streams if they suspect the presence of these fish. The fishermen claim that *piranhas* will gather in schools against the larger fish and attack them. If one of their own number is at all wounded by mistake he is mercilessly set upon and devoured by his companions.

It is useless to try to use nets where this fish is found. They would spoil a net in a few minutes.

Another dangerous fish of these waters is the *sting-ray*. He lies flat on the bottom, his dark upper surface being hardly seen through the muddy streams. If left undisturbed the creature is harmless enough. But a careless wader in the shallows may step on the flat body, and then the great barbed sting inflicts a wound that benumbs the whole body and makes the sufferer speechless with pain. Persons have been lamed for life by such a wound.

A curious fish called *Anableps tetrophthalmus* is often seen there. Its eyes are divided, so that each has two pupils; of these the upper pair are for the air and the lower for the water. This singular fish swims near the surface and near the shore, and if chased does not dive.

A large fish named *caruana* is mostly taken at night. Men go out in boats with lighted torches and spear the fish with great skill and rapidity.

It is said you may often see a native with his bow and arrow standing like a statute on some overhanging bank watching for a fish to pass. When a fish comes near the bow is drawn quick as light, and the arrow hardly leaves a ripple as it cuts through the water. It requires the keenest skill to obtain fish by this means, and the fisherman must also allow for the refraction of the water, or he will certainly miss his mark. Yet many of the large *piranhas* are procured in this way. Good fishing depends, first, upon the flooding of the river, which fills all the valley lakes and channels with water and entices the fish out of the greater streams; then, second, such a falling of the floods as leaves many of these channels and lakes separated from the river. Thus the fish are imprisoned in shoal water and narrow quarters and more easily taken. Otherwise the present contrivances for procuring good fish by these native fishermen would be entirely inadequate.

Wallace, Smith, and others who have made recent explorations of the Amazon all speak of its prospects as a future highway of commerce. They also dwell much upon the abundant and even luxuriant natural resources of the entire region with which this great river and its tributaries is connected.

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NEW INVENTIONS.

Mr. Stephen S. Haight, of West Farms, New York city, has patented improvements in cars for transporting cattle on railroads, the object being to provide separate and quickly arranged stalls for the cattle to carry sufficient stores of food and water for their consumption during a long trip, and to provide most convenient devices for feeding and watering the cattle, and in other ways administering to their comfort and necessities. The invention consists of vertically adjustable gates or partitions of peculiar construction, of food and water receptacles or reservoirs upon and beneath the car roof, of feeding troughs of novel design, of improved devices for supplying food and water to the feeding troughs, and of other novel devices in combination with the above.

Mr. Chester F. Adams, of Toledo, O., has patented an improvement in the class of radiators which are connected with or form attachments of chimneys and flues, and are so constructed that the current of volatile products of combustion may be diverted through them at will for the purpose of bringing such products in contact with a larger conducting and radiating surface, and thereby utilizing the heat more completely.

Mr. Benjamin A. Taber, of North East, Pa., has patented an improvement in that class of bag holders in which the bags are clamped by hinged levers to the bottom of a hopper through which the grain or other substance is fed into the bag. A light frame, having legs, supports a hopper that receives the grain or feed and delivers it into the bag, which is secured to the contracted lower end of the hopper by means of clamping levers. These levers are hinged near the ends of the supporting frame, and have broad inner ends which are beveled correspondingly to angle or inclination of the end of the hopper for the purpose of adapting them to clamp the edge of the bag against the hopper. The clamping is effected when levers are in horizontal position and they are secured in this position by means of ratchet catches.

Mr. George Scott, of Montreal, Canada, has patented an improvement in that class of printers' material known as "quoins," which are used in various ways for the purpose of locking up forms for use in the press. It has more particular relation to that form of quoin in which two wedge-shaped pieces are provided with a straight series of teeth, which are geared together by a pinion key, and are projected over each other to expand the quoin by the rotary action of the key.

COMBINED HORSE POWER AND STABLE FLOOR.

The annexed engraving represents a device which enables a horse to clean his own stable, cut his own feed, run a thrasher, fanning mill, corn sheller, or corn mill, churn, saw, or pump, to wash buggies, clean windows, or wet down lawns, water stock, and put out fires. It is always ready, and can be instantly brought into action. It is adapted for a colt or horse, and may be worked by a bull or a cow. It is always stored, and forms an elastic, well-ventilated stable floor, which permits of the ready escape of liquid manure and is self-cleaning.

The engraving conveys a very perfect idea of the invention, a portion of the stable being broken away to show the construction of the parts below the floor level.

The upright frame of the stable is constructed in the usual way. The floor of the stable has an opening of the full size of the stall. In this opening is placed an endless floor, A, composed of transverse slats and endless belts or chains supported by rollers, B C, which are journaled in a frame supported by a central pivot and capable of being inclined, as shown in the engraving, by means of a screw, D, which extends above the stall partition, and is provided with a wheel by which it may be turned.

A brush or broom is pressed against the under surface of the endless floor by counterweights, E, and serves to clean the slats as the floor is revolved in the operation of cleaning the stall.

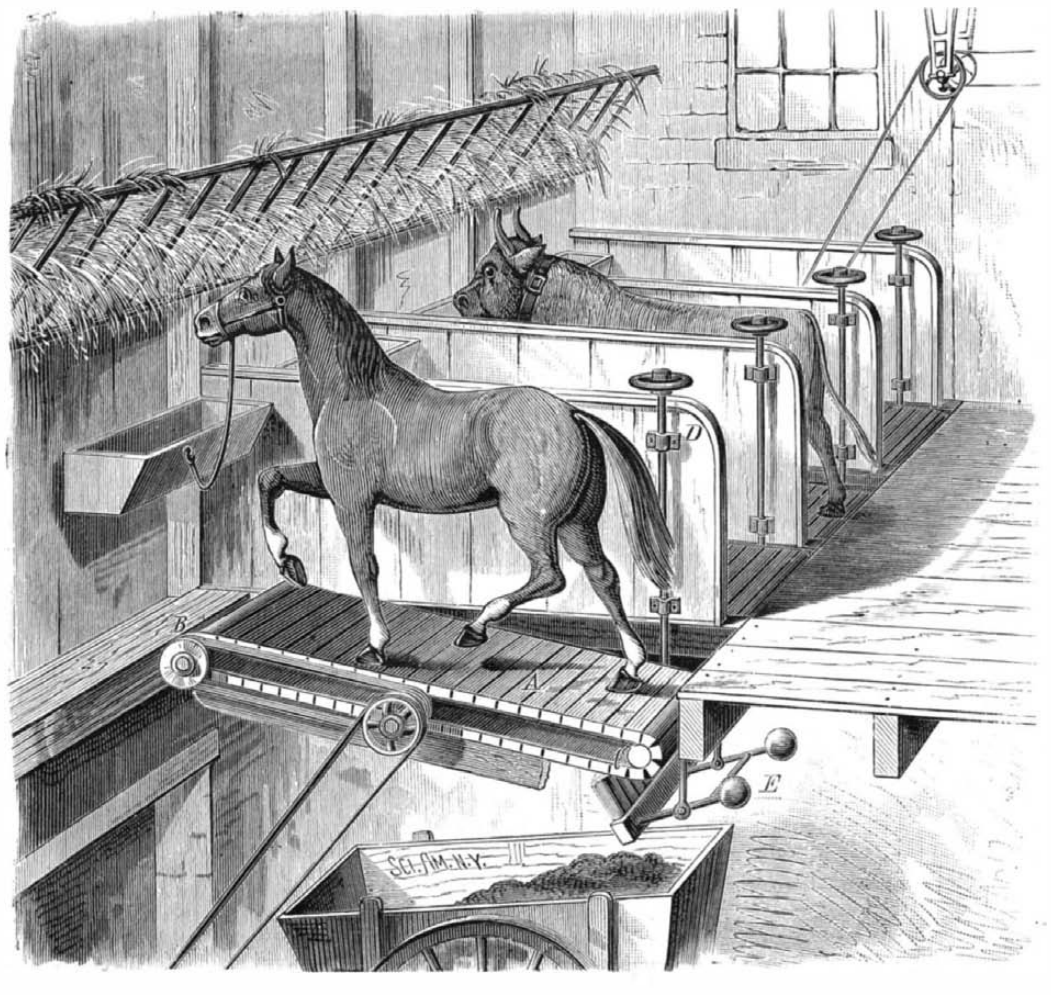
The roller, B, carries a pulley which communicates with a pulley on a centrally located shaft from which power is taken for any purpose. When it becomes necessary to clean the stall all that is required is to release the shaft so that it may revolve, and to incline the stall floor, the manure is delivered to the cart below, and the floor is quickly and thoroughly cleaned.

The inventor suggests the use of this power for driving dynamo machines for electric lighting when the employment of engines or other powers would render it either inconvenient or impossible.

This device affords a ready means of exercising horses without removing them from the stable, and it admits of using younger horses than can be used in other horse powers. It is stated that it effects a cure of "cocked ankle" and knee spring.

The applications of this useful invention will be apparent without further explanation.

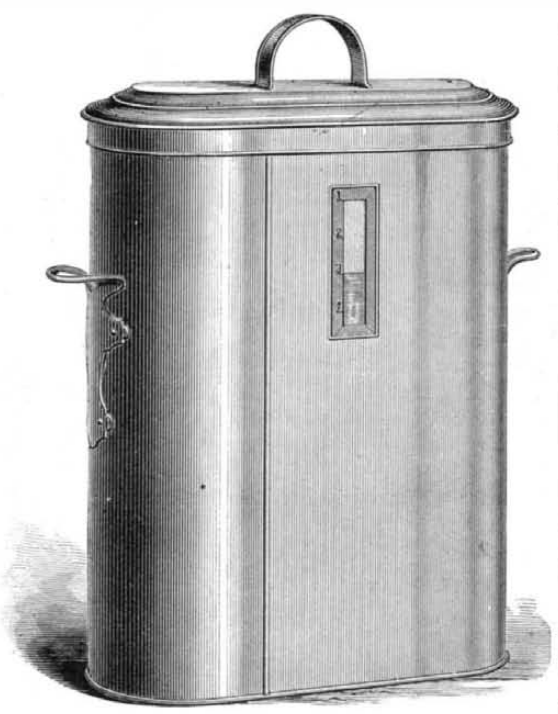
Further particulars may be obtained by addressing Mr. A. Herbert Crawford, patentee, Liverpool, N. Y.



CRAWFORD'S COMBINED HORSE POWER AND STABLE FLOOR.

IMPROVED MILK CAN.

The annexed engraving represents an improved milk can lately patented by Messrs. Brown and Rosa, of Wellsville, N. Y. The novel feature is the form of the can, and in a peculiar cover, which closes the can when partly down, and seals it practically air-tight when pressed fully down. The can is furnished with a window to show the depth of the cream, and is made in what is considered the best proportions for the purpose for which it is intended. The form, as will be noticed, is oval. It is 16 inches long, 6 inches wide, and 19 inches deep. These cans are set in cabinets in the usual way, and surrounded with cold water taken from a spring, or cooled by means of ice. If the temperature is kept at 45° the cream will rise in 12 hours. If the temperature is higher the time will be longer.



IMPROVED MILK CAN.

By the use of this can the cream is prevented from drying, and dirt, flies, and bad odors are excluded from the milk, and good hard butter of a fine quality is secured.

The peculiar form of the cover insures a tight joint at the top, no rubber or other packing being used. The inventor states that these cans prevent the milk contained by them from becoming sour during thunderstorms.

The cans occupy little space and may be readily removed from the cabinets and placed in the sun if desired. They are in use in dairies and in creameries conducted either on the Fairlamb system or on the common plan. They are very simple and less expensive than other cans, and are certainly as durable as any other. The inventors of the can exhibit some very flattering testimonials from persons who have them in use and from experts who have examined them.

Further information in regard to this invention may be obtained by addressing Messrs. Brown & Rosa, as above.

The Sleep Disease.

M. Talmy has presented a note to the French Academy in which he calls attention to the analogy which exists between the "sleep disease" and chicken cholera. The sleep disease (*nelavan*) is a rare affection, which, up to the present time, has been met with only among the negroes of the west coast of Africa. It was first made known by English physicians in 1819, but was not accurately observed till many years afterward (1862 *et seq.*) by the French physicians, Daugaix, Nicolas, Guerin, and very recently by Corre. In this curious affection the person attacked keeps his eyes half closed, as if he were unable to open them wide, and is frequently seized with a profound desire to sleep. Later on he sleeps continuously, and has to be awakened to take nourishment —which he does with pleasure if he is awakened sufficiently. Death approaches very gradually but surely, and the victim passes away at length without suffering any pain. The disease is always fatal, no cure yet being known for it. From the symptoms as given by the above-mentioned physicians, and from the symptoms of chicken cholera as studied by Moritz, Perroncito, Toussaint, and more recently by Pasteur, M. Talmy believes that the two diseases are of a similar character, and both due to a like cause.

California Petroleum.

Great efforts have been made of late to bring about the fulfillment of Professor Silliman's prediction, that California would ultimately be the largest oil producing country in the world. The oil region consists of a section of coast range mountains covering 200,000 acres, and extending from Santa Cruz to Santa Barbara, a distance of 550 miles. During the past four years the Pacific Coast Oil Company have got control of the most of this territory under long leases, and within the past year they have sunk wells which yield good results, built pumping works and refineries, laid down pipe lines, and established factories for the production of casks and barrels. They have now about a score of wells, and hope soon to be able to supply not only the markets of Nevada, California, and Oregon, which require 3,500,000 gallons yearly, but Japan, China, Java, Australia, and Mexico, which require perhaps ten times as much oil.

American Sheep Sent to Australia.

The recent shipment from this port of picked sheep to be used in Australia for breeding purposes is explained as follows by Mr. William G. Markham, secretary of the National Wool Growers' Association: Some time ago Mr. Markham received from Mr. John L. Curry, one of the best known Australian sheep breeders, two entire fleeces, which he said had been taken from his best sheep, and sent here as a sample of what he could breed. These fleeces, and two fleeces taken from American merinos, were, by direction of the National Wool Growers' Association, taken to Boston and scoured. The scourers were given no information as to where the fleeces had come from, and they were all treated in the same manner. After scouring they were examined and appraised by competent and impartial judges. The American fleeces produced 8½ pounds of cleansed wool, while the Australian, when scoured, weighed less than 4½. The Australian fleeces were valued at $4.30, while the price set upon the American was $8.12.

Hearing of this comparison, Mr. Thomas McFarland, a prominent sheep breeder of Melbourne, Australia, who had come here to investigate the qualities of American merinos, visited the principal sheep raisers of New York and Vermont and satisfied himself that the showing was not remarkable. Finding that the American merino sheep combine the two desirable characteristics of large wool-yield and heavy carcasses, he ordered that two rams and two ewes be shipped to Melbourne for him,

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These are not the first sheep sent from American to Pacific countries. Mr. Markham sent three car loads some time ago to Japan, where the government is striving to develop the best wool and carcass-producing animals.

THE ELEPHANT SEAL.

This animal differs from the crested seal by being furnished with a trunk-like extension of the nose of adult males, which has led to the adoption of one of its names, the "sea elephant." The number and arrangement of the teeth are the same as in the crested seal. A great difference is to be found in the claws of the fore feet, which in the elephant seal are merely rudimentary. The general appearance conforms with that of seals generally, but in size it is larger than any of its relations. Although the size has often been overstated, there is no doubt that it ranges from 15 to 21 feet in length. The females attain about one half the length of the males, but not over one third in weight of the male, the weight of the latter often exceeding 10,000 pounds. The head is large, broad, and somewhat elongated, the snout being greatly developed and terminating abruptly, as shown in the illustration. The upper lip has from 30 to 40 long dark-brown bristles arranged in six rows. The eye is rather large, round, and very prominent, the upper lid being destitute of lashes, the eyebrows having eight or ten bristle-like hairs. The ear is unusually small for so large an animal, and is situated not far to the rear and below the eye, and is not furnished with a flange, having the appearance of a hole.

THE ELEPHANT SEAL—(*Cystophora elephantina.*)

Pitchblende in Colorado.

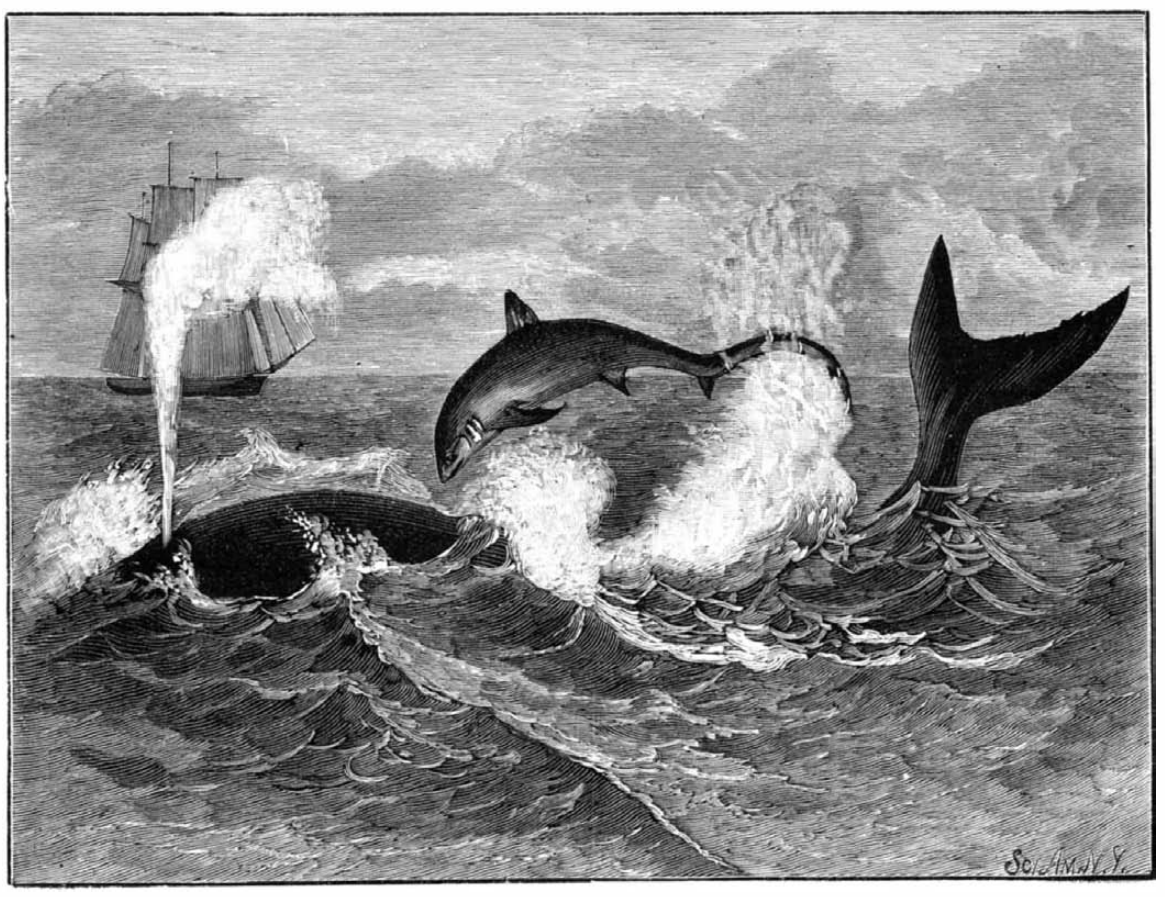
Some three years ago an intelligent mineralogist discovered specimens of pitchblende on the waste dumps of Denver City, Colorado, and, recognizing the value of the mineral, gathered a quantity and sent it to Swansea, where it brought five shillings a pound, or at the rate of $2,500 a ton. To what extent the mineral occurs in that region does not appear, but the incident affords another illustration of the facility with which unscientific miners may throw away minerals of more value than those they are looking for.

Pitchblende, or uraninite, is an oxide of uranium, obtained in Saxony and Bohemia, and used in fine glass making. Glass colored with uranium has the peculiar property of showing green when looked at, although perfectly and purely yellow when looked through.

FIGHT BETWEEN A THRASHER, SWORDFISH, AND A WHALE.

A marine battle between a thrasher, swordfish, and a whale, as witnessed by Lord A. Campbell, of Belleisle, is graphically represented in the annexed engraving. The thrasher—over thirty feet long—attacked the whale from above, springing several yards into the air, descended with fearful violence, inflicting severe slaps with its long flexible tail, while the swordfish attacked the distressed whale from below.

Other authentic accounts are given of similar fights in which the sea around the wounded whale became dyed with blood, and we have an account of a whale taking refuge under a ship to avoid his enemies, much to the consternation of the crew, who hardly dared to step or move while the huge creature maintained its position under the vessel.



WHALE ATTACKED BY ENEMIES IN THE ATLANTIC.

Are Sharks Viviparous?

Recently Mr. E. G. Blackford, of Fulton market, described the discovery of a number of small sharks alive in the body of an old one, and raised the question whether sharks may not be viviparous. Further evidence in the same direction is furnished by Mr. John F. Lovejoy, of this city, in a letter to the *World*. Mr. Lovejoy's shark—about three feet long—was caught last May on Nantucket Shoals. Mr. Lovejoy says:

"It flopped about considerably, and in order to get the hook out of its mouth we were obliged to strike it over the head with a small capstan bar. This must have put the shark to great pain, and at any rate caused spasmodic action of the stomach, for in a few minutes we saw the head of a small shark protruding from the vent of the large one. We pressed the stomach, and first one, then another, came out. Then we cut the large shark open, and to our great astonishment found four more. They were each seven inches long, with an umbilical sac hanging from them about four inches in length and looking very much like a spawn. Seeing that they worked themselves about on the deck, we wondered if they could swim, and dropped them into the water. They immediately commenced to swim, but gradually sank, the sacs seeming to carry them down. This, we think, goes to prove more fully that the shark is viviparous. The sac was not seen on the young taken from Mr. Blackford's shark, which in growing so large had absorbed it and were in a condition to take care of themselves."

A PROMISING VINE.

A French explorer in the valley of the Niger reports the discovery of a vine which promises to be of great economical value. Writing from Koundian (Gangaran), July 25, he says that the fruit of the vine is excellent and abundant; its cultivation is very easy, its roots being tuberose and perennial, while its branches are annual. It can be cultivated as easily as the dahlia. He himself had been eating the large grapes of the vine for eight days, and found them excellent, and he suggests that its culture ought to be attempted in all vine-growing countries, as a possible remedy against the phylloxera. He has sent home seeds for experiment, both in France and Algeria, and intends to bring home specimens of the plant at all stages of development.

Why the Glow-worms Glow.

The French scientist Jousset de Liellesme claims to have discovered that the glow of the glow-worm is a spontaneous action, and that the little insect has the same object in glowing that some Parisian ladies have in displaying certain ribbon streamers, which are very appropriately called "*suivez-moi.*" It has long been known that the female glow-worm alone understands the art of glowing exceedingly well, though the male and even the larva possess some of this phosphorescence. Some earlier scientists expressed their belief that the glowing apparatus in the female served the purpose of favoring the fructification of the eggs, in so far as the male was attracted from the distance by the phosphorescent light of the female. But it was left to our prosaic age to discover that the light was produced by an essentially spontaneous action.

The above named French naturalist made an incision in the head of the female glow-worm (evidently supposing that in this animal, also, the organ of will is in the head), and the phosphorescent light at once ceased, but it returned—and this is the most important fact of the experiment—every time that the action of the brain or of the central nervous organ was irritated by artificial means, such as electricity.

NATURAL HISTORY NOTES.

Phosphorescence of very Young Fishes.—Mr. John A. Ryder, while investigating the development of the bay mackerel and porgy, under the auspices of the U. S. Fish Commission, in Mobjack Bay, Va., found that the latter fish, when three days old, was very decidedly phosphorescent at night, when sudden impulses were imparted to the water in which they were swimming about; acting in this regard like numerous other marine animals, such as medusæ, polyps, infusoria, etc. The presence of an extraordinary development of amœbiform cells over certain portions of the bodies of these little fishes may be the cause of these phenomena. These cells change their form from time to time very considerably, but tend to aggregate in anastomosing clusters over the oil globule in the umbilical vesicle, over the ectoderm of the vesicle itself, and on certain parts of the body and tail. They are very different from pigment corpuscles. Besides these cells a peculiar homogeneously-distributed reddish tinge is acquired by the membranes of the umbilical vesicles of the porgy on the third day, and which is not due to the presence of blood globules. "To whichever of these structural causes the phenomenon of organic phosphorescence is attributable in this special case," says Mr. Ryder, "there seems to me to be little doubt that the prime element in the production of phosphorescence in the animal world in general is some kind of sudden molecular disturbance or impulse, disturbing the equilibrium of the molecules of the living protoplasm involved, so as to produce a kind of motion which makes itself apparent as momentary emissions of light. I have no doubt that the phenomenon in *Lampyris*, or the firefly, is connected with expiration and inspiration, and possibly, in the *Medusæ*, with the rhythmical contraction of the umbrella. The application of experimental methods to verify the above suggestions would be very easy."

Relation of Algæ to Flower-

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ing Plants.—Dr. Krause, in a recent number of *Kosmos*, has discussed the relationship existing between the algæ and phænogamous plants, taking as the special subject of his inquiry the *Podostemaceæ*, which, as well known, are aquatic plants growing on stones, some with the aspect of seaweeds and others of mosses or liverworts. The species of this order, he believes, combine characters of the algæ and flowering plants, and show a direct transition between them. Indeed, the resemblance is so striking, and the forms of both so variable, that one would be excusable for inferring that the podostemes are algæ with flowers. The flowers of the podostemes, moreover, are either apetalous or imperfect, and very simple. The plants are inhabitants of running water in Asia, Africa, and America—being represented in the latter country by a single genus and species, the river-weed (*Podostemon ceratophyllus*). The lower forms are composed of little else than parenchyma, while only the larger ones have vascular organs. The stem is either wanting or assumes a great diversity of shapes, and has scarcely any true roots. The leaves are mostly wanting in the thallus-like species, but are highly diversified in the stemmed species. The veins, when present, are dichotomous, seldom parallel The buds, both of the stem and flowers, are folded convolutely. The cushion-like organs of attachment, which take the place of true roots, are found elsewhere only among the algæ. The absence of vascular organs is common to algæ and mosses among cryptogams, and also to a few phænogams, as the *Naiadaceæ*, *Ceratophyllaceæ*, and *Lemnaceæ*. Since the lower plants of these orders show no differentiation of stem and leaf, at least no more than the algæ, it is suggested by Dr. Krause that they might be placed, with the *Podostemaceæ*, in a group representing a direct transition between the algæ and phænogams, and for which he proposes the name *Anthophyceæ*. If the *Cytineæ*, which have no cotyledon, and the *Balanophoraceæ*, which have only a simple undivided embryo, be regarded as higher forms rising out of fungi, we may join them as *Anthomyceteæ* with the *Anthophyceæ* representing the lowest phænogams, as *Anthothalloideæ*.

A Gluttonous Fish.—The Smithsonian Institution has received a curious specimen of fish, which was taken on the fishing banks of Gloucester, Mass. Scientifically it is known as *Chiasmodus niger*, and its peculiar and distinguishing feature is the fact that its rapacity leads it to swallow fishes which are twice as large and which weigh twice as much as itself. It is enabled to do this from the fact that its mouth is very deeply cleft, its teeth bent, and that its stomach has an elasticity resembling that of India-rubber. When it begins to swallow its food its jaws move alternately and seem to climb over the fish, which is gulped down and doubled up in this curious creature's inside. As the process of digestion and decomposition takes place and gases are originated, the distended stomach becomes lighter than the upper part of the body, so that the latter frequently turns under. In this condition the fish is utterly unable to help itself, and may easily be caught. This specimen, secured by the Smithsonian, is only the third known. The first was found a number of years ago floating in the sea off the Island of Madeira, and the second was discovered in the Dominican Sea. Careful drawings have been made of this particular specimen, which is ten inches in length. It has in its stomach a kind of codfish, eighteen inches long. It is only by contrasting the long and slender body of the fish in its normal state with its distended form after gorging, that a proper idea of the feat it so successfully attempts can be gained.

A New Harvesting Ant.—According to the Rev. G. K. Morris (in *American Naturalist*), we have a true harvesting ant at our very doors. In Vineland, at Island Heights, Ocean Grove, and Asbury Park, they are very numerous. It is a small ant, the worker being about a line long. It is of a reddish-brown color, and has a rather large head. The head of the soldier ant is a marvel for size, being many times larger than the abdomen. The soldiers appear to rule the community, and certainly furnish the brains of the family, in bulk, at least. They are ferocious, murderous warriors, and a battle between them is a terrible thing in a small way. They cut each other in two and yet continue to fight. Mr. Morris had the true character of these ants revealed to him by observing rejected husks of seed piled up by their doorways. They appear to do their house cleaning in the latter part of June, to be ready for harvesting the new crop of grass and other seed now ripening. Here and there, however, a careful eye may detect signs of some later work in husks just brought from below. Grass, clover, sorrel, or other seed put near them will be seized and carried below with eagerness. They have a violent antipathy to the little yellow ant—the pest of the pantry—and this fact may be used in recognizing them."

Experimental Transformation of a Living Organism.

The bulletins of the Academy of Science at Munich contain a report of a discovery which has the highest interest for the theory of evolution and will perhaps be also of practical value. Hans Büchner, well known as a skillful experimenter, has succeeded in transforming a microscopical kind of fungi, which is a dangerous agent of disease, into another kind of fungi which is perfectly harmless. He reached this result by a continuous treatment of the fungi for the space of six months, and by producing 1,500 generations. In this manner he was able to transform those bacteria that cause "milzbrand" (the dreaded inflammation of the spleen), into the so-called "heupilze" (fungi of hay), which are harmless, and *vice versa*. And even more, he produced an organism that forms a connecting link between the above named fungi, and which was hitherto unknown. To give a detailed description of the experiment would take too long. We only mention two facts which will show with what organisms the experiment was made. The hay fungi, such as can be produced in an infusion of hay, have such an enormous vitality that their life cannot be destroyed even by boiling the liquid which contains them for hours, and each of these little beings is able to propagate itself and to produce ten generations per day.

MALIGNANT DISEASES OF PLANTS.

The study of vegetable nosology, or the diseases and injuries to which plants are liable, is a department of botanical science which hitherto has not received the attention which it deserves. Writings on the subject are comparatively few, many of them empirical, and but few throwing much light on the subject. Intimately connected with the prosperity of horticulture and agriculture, it is a matter of great importance, and this being recognized it is now beginning to receive the attention which its importance demands. Our intention in this article is not so much to advance theories on the subject as to direct intelligent observers, especially fruit growers, in the line of observation and experiment, and to throw out some hints which, if properly followed out, may help to clear up this hitherto obscure subject. We do not propose to treat of the injuries produced by accidents or the attacks of insects, but only of diseases producing disorganization of the tissues of the plant and ultimately resulting in great injury to it, and frequently its death and consequent pecuniary loss to the cultivator.

Plants in a high state of cultivation are more or less predisposed to disease. This is due to the unnatural and excessive development of particular structures or substances caused by high cultivation, and so producing a general morbid condition of the plant, predisposing it to disease whenever the conditions of cultivation are too strongly or too suddenly opposed to those of nature; making exciting causes act with great intensity whenever the predisposition exists.

Modern investigations in vegetable anatomy and physiology all point to a close analogy between vegetable and animal life, and to a similar analogy between many of the diseases which affect both of them, at least in so far as such diseases produce disorganization or destruction of the tissues. Mr. Meehan, of Philadelphia, in a recently published article, gives the results of some microscopical investigations which he has made upon pear blight, and suggests that it is analogous to melanotic or black cancer. The black knot in plum and cherry trees is certainly analogous to a gangrenous ulcer. The disease known as the "yellows" in peach trees is so similar in many of its symptoms to syphilis that it may be called vegetable syphilis. In the cacti family we have a form of anthrax or malignant pustule, in which the whole interior substance of the plant becomes black and rots away into an offensive black mass. The action of frost upon the succulent shoots of plants is almost identical with its action on animal structures in producing destruction of the parts exposed and their subsequent sloughing off. The deleterious effects of the gases escaping into the atmosphere from chemical works in manufacturing certain chemicals is as injurious to vegetable life as it is to animal life, and sometimes even more so; the liquid waste from other manufactures escaping into rivers or ponds is as destructive to the aquatic plants therein as it is to the fish.

While plants have not stomachs as animals have, they nevertheless have organs of nutrition, through which they take up their food in a soluble form. The process is similar in both animal and vegetable life; in the first, the food in the solid state is taken into the stomach, to be there rendered soluble before being absorbed into the system; in the latter, it is rendered soluble in the soil, whence it is taken into the plant. But in some so-called carnivorous or insectivorous plants we have, as in dioncea, an apparatus which catches insects, secretes a fluid similar to gastric juice to digest them, and then absorbs all the parts dissolved; just as is done by some of the lower forms of polypi or medusæ, which catch aquatic insects and folding their skin over them absorb all that is soluble of them. Similar action takes place in pinguicula, drosera, and other genera of plants. In others, such as utricularia, we find bladders attached to the plant; these are furnished at their mouth with peculiar hair-like processes or cilia, which have a vibratory motion, and in this and in their general appearance resemble many forms of polypi and medusæ. These bladders entrap minute aquatic insects, which being digested in them the soluble parts are absorbed by the plant. They are in reality outside stomachs. Again, we have in sarracenia, in nepenthes, and some other genera, large tubular leaves or outside stomachs, furnished with various appliances for catching insects and digesting the soluble parts. All this goes to prove the analogy of which we have spoken; we might extend it still farther into the processes of respiration and reproduction, and show similar striking points of resemblance. This being the case it is reasonable to infer that in so far as their difference of structure will admit, plants may be liable to diseases similar to those of animals. If these latter can be cured by medical skill, why should not the diseases of plants be likewise cured?

Many pathologists ascribe the cause of some of the cancerous affections in the human body to cachexia, or a condition in which the system of nutrition is depraved. This being the case, should we not in such diseases as pear blight endeavor to ascertain the causes of such depravation, whether they are in the air or in the soil, and when in the latter endeavor to remedy the evil? Amputation is the general remedy, but where the disease attacks large numbers of trees in any section of country, it is reasonable to suppose that its cause must be in the soil. Perhaps introducing some antiseptic drug under and below the diseased parts so that it might be dissolved and carried up in the sap might destroy the destructive action, or even the introduction of some drug into the tree by means of small gimlet holes into the trunk or branches might be of service. What these drugs should be, or in what quantity they should be, we know not, our object being to draw attention to a certain line of experiment which we believe has not before been suggested.

The common idea is, that the class of diseases in fruit trees to which we refer is due either to injurious atmospheric or meteorological causes, to insects, or to fungoid growths. The first may no doubt have, in certain cases, much to do with it; as, for instance, an excess or a deficiency of ozone in the air, which by its remarkable oxidizing power may materially affect the various chemical changes going on in the organization of the plant. Lest some of our readers may not fully understand what this mysterious agent is, we will state, on the authority of Prof. Dunglison, that ozone is a powerfully odorous matter, produced when a current of ordinary electricity passes from pointed bodies into the air. It is generally presumed to be a peculiar modification of oxygen; and in varying quantity in the atmosphere is supposed to affect the health of man. By others, ozone is considered to be oxygen condensed to two-thirds its bulk, when it possesses remarkable oxidizing properties. It can be artificially produced by placing phosphorus in a flask filled with atmospheric air and partly covered with water, occasionally agitating the flask. So, too, an occasional change in the normal condition of the atmosphere by an excess or deficiency of its gaseous constituents, or the presence of other gases, may induce cachexia. In the full grown human being the lungs expose fourteen hundred square feet of surface to the action of the air inhaled. Large as this surface is, that of a good sized tree, through its leaves, is vastly greater; and just in such proportion must be the injurious effects of a vitiated atmosphere upon it.

The presence of insects in a degenerated tissue is not *prima facie* evidence of their being the cause of the degeneration. A neglected gangrene will become full of maggots, but they were not the inciting cause. The same may be said of fungi, particularly of such as the yeast plant, which develop whenever chemical changes incident to cremacausis or decay present themselves in any organic matter or living organization. The mildew on grape vines is well known to be caused by atmospheric influences; the mildew or fungi is not a cause, but only a secondary effect. Sulphur, or rather the sulphurous acid gas which it contains, is a specific cure for it, generally supposed to directly destroy the fungus; but it more probably destroys it by the gas being taken up by the leaves of the plant, thus absorbed into its sap, and so restoring the leaves to a healthy state, which in such a state do not afford the food necessary to the life of the fungus, and it therefore perishes. All these gangrenous diseases of plants are contagious if any portion of the diseased plant is introduced into a healthy one. If a knife used in pruning such a diseased plant be afterward used in pruning a healthy one without proper cleaning, it will communicate the disease from the first to the latter. As much care must be used in cleansing it as a surgeon would use in cleansing his instruments after an operation for cancer or gangrene, before again using them upon a healthy person in some other operation. In the "yellows" in peach trees the disease is no doubt mainly communicated through the organs of fertilization, the pollen of the diseased tree coming in contact with the stigma of a healthy one, and communicating the disease in the same way as syphilis is communicated to a healthy mother through the fœtus derived from a father having a syphilitic taint. This disease is so virulent that the roots or branches of a diseased tree coming in contact with the roots or branches of a healthy one will communicate the virus.

In conducting such experiments as we have suggested, absorption of air and water by the roots and leaves, and also the processes of exhalation and respiration by the latter, should be studied as a means of detecting the causes of disease and indicating the methods by which remedies may be applied to restore them to health when diseased. There is a certainty, at least, of insentient life in plants, if not a close approach in some to sentient life. Some forms of it may be chemico-vital action, but others are different and of a higher character. Vegetable physiology and anatomy have received great attention from learned botanists; their researches have been of much practical service to cultivators, and have done much to advance the arts of agriculture and horticulture. To these two branches of botanical study we shall soon have to add that of nosology and therapeutics. Veterinary science has advanced from mere empiricism to a strictly medical science. Agriculture and horticulture are but arts as yet, in which there is much groping in the dark. We now have agricultural colleges in which are many learned professors, who can do much to elevate these arts to science. The elevation of veterinary art to science has been of great pecuniary value to many nations; a similar elevation of agricultural art to a similar scientific standpoint would be of equal value. When we look at the immense values of our crops and their vital importance to the people, we cannot but recognize the necessity of preserving them from disease and the consequent pecuniary loss it involves.

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MISCELLANEOUS INVENTIONS.

Friction and percussion tubes have been made for insertion in the vent holes of cannon to fire them; but, as is well known, the vent becomes enlarged by use, so that the tubes fit loosely, and either blow out without igniting the charge in the cannon, or else the tubes break off below the firing wire, on account of not being firmly held. Mr. John B. Rodman, of Fort Brown, Texas, has patented a primer for cannon which holds the priming tubes securely, and thus insures their proper operation.

A device for removing old caps from and inserting new caps in cartridge shells which have been exploded, has been patented by Mr. Heber W. Harrington, of Fort Dodge, Ia. The invention is also adapted to be used in capping new shells. It consists in a novel construction and combination of a tubular plug and a punch or piston working therein, the details of which cannot be clearly described without engravings.

It is well known that in the burning of factories, hotels, and private dwellings serious injury to the person and loss of life are of frequent occurrence because of persons jumping from windows. Mr. Thomas Bickerton, of Lawrence, Kan., has patented a device designed to prevent the occurrence of such accidents. It consists of a frame lined on sides and ends with mattresses, and having a movable bottom consisting of a mattress suspended by elastic cords.

An improved vise that may be easily operated by the foot of the workman to forcibly clamp the jaws of the vise upon the work while the hands are free to hold the work has been patented by Mr. William S. Lord, of Brownsville, Tenn. It may be immediately adjusted to adapt the jaws to embrace the work before the clamping movement of the jaws is exerted.

An improved grate for stoves and furnaces has been patented by Mr. Isaac Hayes, of Philadelphia, Pa. The invention consists in a grate composed of cross bearers that are fitted for being rocked and support the grate bars. The bearers are moved by a rock lever and handle that is connected with two of the grate bars, whereby the bearers and grate bars are vibrated alternately in opposite directions.

Hygiene of Photography.

At a recent convention of Photographers at Chicago, Dr. Norman L. Briggs, of Rush Medical College, was announced to read a paper on "Poisons of Photography." He gave instead a brief practical address on the hygiene of photography, in which he said that photography, though not an ideal occupation, could not be an unhealthy one. An ideal occupation was one that required one to indulge in a variety of muscular motions. There were very few occupations ideal; one man labored with his hands, another with his legs; another was exposed to gases, and another to dust, the latter, by inhalation, producing lung diseases; still another class, such as people who work in gas works, was exposed to high temperatures, while yet another class, who work with their feet in the water, caught cold and were attacked with rheumatism, Bright's disease of the kidneys, etc. Photography was an occupation conducive to good health, as it required a great variety of motion, and was of the lighter occupations. It also dealt with the mind, being an artistic employment. There were certain chemicals photographers used that were detrimental to health, and there were a number of gases and solid substances that photographers were compelled to come in contact with. Among the fumes they inhaled were those of alcohol and ether. The latter was a stimulant to the animal body, and the effect was detrimental, many of the nervous disturbances being attributable to it. The vapor of alcohol was no more harmful than if taken in the stomach, and was as great. Acetic acid vapors were harmful if one was exposed to them a great deal, but the amount of fumes of that drug that photographers were exposed to was small. The fumes of hydrocyanic acid were exceedingly harmful, as well as those of iodine and bromide, these latter causing a sallowness of the complexion and producing eruptions of the skin. But those fumes were rare.

The solids that photographers came in contact with were exceedingly harmful, notably nitrate of silver, in the solution of which photographers put their hands. The absorption was slight, but they got some silver in their systems. Physicians found it valuable in some diseases. It produced symptoms of general debility; the patient looked sour, digestion was bad, the tongue coated, secretions sluggish, and the person was generally ill. They should avoid it as much as possible. Iodide of potassium solutions were slightly harmful, and bichromate of potassium was exceedingly harmful, producing irritation of the mucous membrane. Persons who manipulated that drug had eruptions of the skin and irritation of the mucous membrane—ulceration of the latter, etc. No person could work with it without ulceration of the bronchial tubes.

Another solid substance was cyanide of potassium, used for cosmetic effect—for the removal of stains from the hands. This drug would do more harm than the silver would.

The question was: How could they avoid injury? In acute poisoning something might be done in the direction of an antidote, but not generally as much as was supposed. Little could be done in the shape of antidotes in cases of chronic poisoning, which produced symptoms of nervous prostration, loss of sense of hearing, and fading of the sight.

Chloride of gold and sodium were harmless, and pyrogallic acid was harmful if it came in contact with certain parts of the body. What were the measures that could be employed to remove the injuries caused by those poisons? The first thing to do was to avoid getting those poisons in the system. The gases might be rendered innocuous by dilution, which could be done by atmospheric air. It was possible to ventilate photographers' dark rooms well without interfering with their work. They should have several small openings in the apartments. A tallow candle or a small kerosene lamp, placed in a little flue so that it would cause the air to pass up would ventilate a room. By diluting the gases the photographer would cease to inhale them.

About the solids: He knew but one way to obviate their effects, and that was to avoid touching them, or, if they did it should be done with protected hands. The doctor thought tongs or forceps could be used to put the plates in solutions. He advised photographers to take less of stimulants while they were inhaling other stimulants. That brought forth laughter and applause from the delegates, and Dr. Briggs said he meant alcoholic stimulants to some degree. They should, he said, eschew tea, coffee, and tobacco; they could not take one stimulant to kill another, and should avoid as far as possible taking in the stomach all unnatural things. They should also avoid all strong stimulating condiments, such as cayenne pepper, etc. The photographer might indulge in athletic sports—play base ball, swing Indian clubs, or use the health lift. He should be out of doors as much as possible. He might indulge in a little free exercise, and a little medication might be allowed. He should avoid contact with and dilute the poisons; get good recreation and avoid the overuse of stimulants. The speaker believed the profession of photography ought to be as healthy as any in the land. He knew that photographers as a rule were chemists, and as years went by chemistry was being more and more studied by them. The danger from poisoning would grow less as years passed by.

Hunting for Submarine Treasure.

A schooner, owned by a Connecticut "Submarine Company," is being used in exploring a sunken wreck off Round Island, near Peekskill, on the Hudson. The wreck has been there many years, and is reputed to have been the ship of the famous pirate Capt. Kidd. A visitor found among the appliances of the schooner a great variety of machines, chains, pumps, rubber tubes, and other contrivances, for bringing treasure out of deep water. Chief among these was a large diving bell, of boiler iron, with little round windows on every side, so that the man inside can see out in every direction—up, down, and across. It is kept in a well in the hold, and when it is to be used, bolts at the top are unfastened, the man climbs in, and the bolts are again fastened, the top being put on so tight that the affair is both air and water proof. The sensation of being bolted into this narrow iron prison for the first time is said to be terrible, though the experienced divers do not mind it. There are two rubber tubes attached to the top, one to carry off the exhausted air, the other to supply fresh air. When the man is fastened in, the air pump is started, and the bell is hoisted out with an immense derrick and lowered over the side. This bell can operate in 300 feet of water, and is, of course, raised or lowered by steam. When all is ready it is lowered to the bottom. The man inside looks through his windows, and determines what must be done first. He has wires to pull to signal the men above. He can tell them to hoist, lower, give him more or less air, or any other signals that may have been agreed upon. Attached to the side of the diving bell, and operated by steam, from above, is what is called "the arm"—a heavy attachment, provided with so many joints and swivels that it is capable of making all the many motions of the human arm, with much greater strength than any human arm ever had. This arm has a hand, with fingers, that hold a saw, an axe, a crowbar, or any instrument desired. If the man in the bell desires to saw, he is drawn up, a saw is put in the steam hand, and he goes back and begins work. When he wants an axe or a hammer he is drawn up again, and the tool is changed. The iron bell is almost human in its capacity for work, and, with the brains of a man inside, it is a valuable laborer. When the work is in very deep or dark water, or at night, an electric light is attached to the bell, and the bottom for many yards around is made as bright as if the sun shone upon it. The effect upon the surface of the water of this bright light underneath is said to be dazzling and beautiful, and some of the Rip Van Winklites who live up yonder on the hills may well begin to wonder when they see the bottom of the Hudson bright with electric light and a steamman digging for a pirate's treasures.

Energy Developed during Rains.

Professor Tait, of Edinburgh, thus illustrates the gigantic scale upon which nature performs some of the most ordinary of her operations: Suppose a mere tenth of an inch of rain to fall from the lowest mile of the atmosphere. An inch of rain is 5 pounds of water to the square foot, and gives out, on being condensed from vapor, approximately, 3,000 units of heat, on the Centigrade scale. The mass of the mile-high column of air, a square foot in section, is about 360 pounds, and its specific heat about a quarter that of water. Thus, its temperature throughout would be raised by about 33° Centigrade, or 60° Fahrenheit. For one-tenth of an inch of rain, therefore, we should have a rise of temperature of the lowest mile of the atmosphere amounting to 3·3° Centigrade—quite enough to produce a very powerful ascending current. As the air ascends and expands it cools, and more vapor is precipitated, so that the ascending current is further accelerated. The heat developed over one square foot of the earth's surface under these conditions is equivalent to work at the rate of a horse power for 12 minutes. Over a square mile this would be 10,000,000 horse power for half an hour. A fall of one-tenth of an inch of rain over the whole of Great Britain gives heat equivalent to the work of a million millions of horses for half an hour! Numbers like these are altogether beyond our comprehension. They enable us, however, to see the full explanation of the energy of the most violent hurricanes in the simplest physical concomitants of the mere condensation of aqueous vapor.

Patents and Science.

A paper was read at the late meeting of the American Association by Mr. B. S. Hedrick, Examiner at the Patent Office, Washington, D. C., on "Patent Laws as a Means for the Advancement of Science." The proper aim of science was defined to be the making of discoveries. The discoverer of a new mineral, a new plant, a new law in nature, or a new world, has no proprietary right in his discovery. The honor and distinction he obtains is his reward. A discovery, then, cannot be the subject of a patent. The laws of nature, the properties of matter, the physical forces, and the laws of their generation and government, are, like the earth, the air, and the water, the common property of all. Property in the former, as in the latter, is created by enactments. But in civilized communities the reason for the law is that something has been added to what was given by nature. The land has been fenced, plowed, and planted, or buildings placed upon it that give the foundation for proprietary right. And public policy requires that this right be recognized; and civil, municipal, and common law does this in the case of the land, the air, and the water. Patent laws do the same when discoveries, the properties of matter, forces, the laws which govern them, are made to take the shape of useful invention. The invention which the inventor created is secured to him as his property for a period at least. But not the laws themselves. It is the reflex action of the invention that promotes the advancement of science. Illustrations were given by referring to Watt's steam engine in advancing our knowledge of the laws of heat; the telegraph, in giving a new development to the science of magnetism and electricity; and now the telephone and other kindred inventions serve to push our knowledge into the fartherest and outermost borders. The protection given by patent laws enables the great host of investigators to carry on their researches, and, instead of becoming a tax and burden to the community, they help both themselves and others to bear a full share of the ordinary burdens of society. Reference was made to Wheatstone, Bessemer, the brothers Siemens, Perkin, Graebe, Sir William Thomson, and others in Europe, and to Morse, Page, Henry, Gale, Bell, Edison, and many others, members of the American Association—men who have greatly advanced science, and have received of the rewards which flow from the operation of patent laws.

Young Rats Tied by their Tails.

A correspondent writing from Richmond, Va., wants to know if it is the custom of rats to tie up their offspring by their tails. He lately found "four young rats, each one neatly tied around the left hind leg with his own or his sister's or brother's tail, and all tied together at a common center and neatly interwoven, on a fabric of downy feathers which composed their nest." Our correspondent will find an engraving of rats tied in this manner, with an explanation of the matter, in SCIENTIFIC AMERICAN SUPPLEMENT. No. 234.

Subcutaneous Injection of Ether in Sciatica.

Dr. Comegys, in *L'Union Médicale*, recommends hypodermic injection of sulphuric ether for the treatment of sciatica. He cites two cases, one in detail, which he has cured by this plan. Three drops of ether are injected at intervals of twelve hours. The injection need not be a deep one; and though it causes a momentary sharp pain, it does not bring on any consecutive unpleasant effects. Dr. Comegys is inclined to think that the same injection might be successful in the case of tic-douloureux, for which Dr. Marino recommends hypodermic injection of ergotine.

Tasteless Cod Liver Oil.

Dr. Peuteves, in *La France Médicale*, recommends, in order to render cod liver oil tasteless, to mix a tablespoonful of it intimately with the yolk of an egg, add a few drops of essence of peppermint, and half a tumbler of sugared water, so as to obtain a *lait du poule*. By this means the taste and characteristic odor of the oil are entirely covered, and the patients take it without the slightest repugnance. Besides, the oil, being thus rendered miscible as the water in all its proportions, is in as complete state of emulsion as the fats at the moment they penetrate the chyle vessels, consequently absorption is better assured.

The Utilization of Saw Dust.

The saw dust, which has become such a nuisance at Minneapolis and along the river below that growing city, offers a promising field of enterprise for whoever will utilize it. Several applications have already been made of it, and now arrangements are being made by a French manufacturing chemist for the establishment, at Minneapolis, of a laboratory to make from the saw dust an acid, now imported from France, and largely used by dyers, chemists, and druggists. It is to be hoped that the enterprise will be successful.

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THE CINCINNATI INDUSTRIAL EXPOSITION.

The machinery department of the Cincinnati Industrial Exposition contains enough to occupy a whole page of your paper. So I will give only a birdseye view of what is there to be seen.

A machine for making wire nails complete requires but little attention. Near it stands a nail-driving machine used for joining boxes. A large machine for making barbed wire fences is in operation.

A shoe manufacturer has a dozen or more employés at work making shoes. Most of the branches of labor are carried on in full view of the visitors, and usually attract a crowd.

A firm with emery wheels comes from Boston, another is from Detroit.

A thread spooler winds the cotton of John Clark, Jr., and a spool of cotton is presented to each passer by.

The Corticello Twist and Silk Company have a machine in operation for winding silk, and the exhibitors are almost lavish in their advertisement, which is not needed to those who have ever used their goods.

A sewing machine brought from Chicago stands in the vicinity. It is propelled by electricity. The attachment can be made to any machine, and costs $25. The owner has one order for twenty-five machines to be used in a shoe factory in Massachusetts.

Weaving by the Jacquard loom draws crowds of people. Two of the looms are from Paterson, N. J. One is making handkerchiefs of various colors and patterns, the other bookmarks. The one making bookmarks is certainly a wonderful and complicated affair. Near the loom stands a machine for weaving gros grain dress silk. It is operated by the hands and feet, and made like those used in France.

A something novel to me was a machine from Boston for shearing sheep. It is to be moved by steam or water power. The machine is to be leased—not sold. It is suitable for the ranches of California, Kansas, and Colorado. It never cuts the sheep in shearing, which is one humane result that it effects.

A small but very useful contrivance is a clothes sprinkler. Laundry women should tender a vote of thanks to the inventor. A key hole guard, originated by a German of this city, is simple but ingenious. A new method of connecting the joints of stove pipes is likely to prove available. I observed from Boston a cordage that I think is unsurpassed for strength and durability. The manner in which it is woven is peculiar.

The Slater Woolen Company, of Webster, Mass., makes a large and handsome display of 52 pieces of broadcloths, doeskins, etc.

A fire escape is well worth the attention of hotel keepers and manufacturers.

An ice machine, said to be invented in Prussia, is much smaller than the American one exhibited last year.

A simple yet useful invention is a show case from New York containing the Waltham watches. The doors, by which salespeople take articles from the show case for examination by purchasers, slide down vertically, and so are not in the way of the clerks passing through the narrow space at the back of the counters. The Esterbrook pens have a large and varied display.

Van Duzen & Tifts' bells range in size from a cow bell to a church bell. Evans' artificial legs seem to be preferable in some respects to natural ones. The motion of the ankle adjusts itself to whatever position the limb takes. The flesh tints are perfect. A patented flour chest is a treasure to housekeepers. Dentiphones modestly lie in a small case, unused and unexplained. Three telephone displays are in the main hall. A sponge in a glass, that serves as a reservoir for feeding it with water, is a good contrivance for book-keepers and bankers to moisten their fingers. The granite iron ware of St. Louis, now so much in vogue, is well represented. A water cut-off is to turn the water from a cistern, until the first water, which is not clear, has run off, and then convey the clean water to a cistern. It is also useful in cutting off the water supply when the cistern is full.

A wooden woman, dressed in fantastic style, is the operator at the Exposition, and occasions many a merry laugh.

Hamilton, Ohio, has much machinery on exhibition; also some mantels and marble statues. A lithographic press is exhibited by MacBriar. It is of English make, and cost $950.

The usual large number of washboards, wringers, clothes driers, and knitting and sewing machines, are collected together. A wagon cover that can be folded or taken off entirely, and that can be moved so that a portion will project either forward or backward, seems to me a paragon of convenience for country people and expressmen. Folding and extension iron and steel gates are well worth the attention of storekeepers, livery stable men, and brewers. One is used in the rear of the Exposition building. Cincinnati is so noted for its musical talent and culture that many pianoforte manufacturers and dealers make an exhibit of their instruments and employ skillful musicians to play on them in the afternoon and evening, so that by auricular demonstration visitors may learn their comparative merits. A bookbinder's wire stitching machine comes from Boston, and may work a revolution in the old method of uniting the leaves of books. Caldwell's grain conveyor, of St. Louis, takes with the millers. Timmerman's furnaces for evaporating fruit can be used indoors or outdoors, and utilizes all the heat generated. The fruit is bleached by the fumes of burning sulphur, but it is harmless.

Mrs. Short, of this city, exhibits five inventions of her own, namely, a cleansing powder for paint, a machine for washing blankets, a mangler and ironer, and a lace curtain stretcher.

The electric lights used in front of the Exposition building, in the vestibule, and the main hall, have the name as inventor of Maxim, New York. The *modus operandi* has been lately described in the SCIENTIFIC AMERICAN.

One of the most useful inventions is that of an arrangement placed under the boilers of the Exposition building. The inventor is Mr. Murphy, who hails from Detroit. He ought to take up his residence in Cincinnati, and get the city officials to pass an ordinance against manufacturers and others letting volumes of black, dirty smoke belch forth from their chimneys. In that way he could promote the comfort and health of the people and earn a fortune for himself. But a friend sagely remarks there is one great objection to its adoption by the city authorities for the water works, and that is that the steam stoker does not vote, while the twenty men that could be dispensed with do. Murphy's smokeless furnace is creating unusual interest in consequence of its remarkably successful operation. All coal fed to the furnace is passed through the hoppers, and dealt to the grate in a partially coked state and in small charges. The operation of the furnace may be stated as follows: The coal is pushed on the grate and remains there long enough to be coked. The gases then being released, the next charge forces the coke forward down the grates. This furnace is not, therefore, a "smoke consumer," for the smoke is never generated. It is, properly speaking, a smokeless furnace, or a smoke preventer.

The Union Electric Signal Company, of Boston, exhibit a practically successful system of operating railroad signals automatically. Each section of a mile of track is insulated from that preceding and following it. If a rail is anywhere displaced or broken, or a switch or drawbridge turned, there is no circuit, consequently no current, hence a "danger" signal must be displayed until the rail is relaid, the switch replaced, the bridge closed, or the destruction of the washout repaired. If the battery were neglected there would be no current, and a danger signal would be shown until it was attended to.

So it is with each section. The engineer sees by the signal just the state of the track for a mile ahead of him all the time, and the track and train themselves are made to announce their state automatically and positively. Thus it is impossible for the signal to give the train a signal of "safety" when there is danger ahead. If a track is single, and trains run both ways on the same track, it is required that signals be displayed not only at the end at which the train is entering, but also at the other end. That is to prevent a train entering a section, and so avoid meeting a train already started from the other end.

Secondary or cautionary signals are also used, which announce at a considerable distance before the section signal is reached, the state of affairs, and thus prevent danger from insufficient warning. VIRGINIA PENNY.

Cincinnati, Oct. 8.

THE AMERICAN INSTITUTE FAIR.

The fair of the American Institute is now at its best, all of the exhibits are in place, the patronage is large and well merited, and while we do not find anything as remarkable as the telephone, phonograph, and electric light were, on their first appearance in past years, the exhibition is very satisfactory.

The electric light, which was absent at the date of our last visit, is now supplied by two firms, the United States Electric Lighting Company, of this city, who light a portion of Machinery Hall, and the Fuller Electrical Company, also of this city, who light the main hall and also furnish lights at the front and rear of the exhibition buildings.

Among interesting objects in Machinery Hall we find Volkmar's apparatus for drying fruits, vegetables, fish, and meats by cold air, avoiding decomposition which accompanies high temperatures.

Mr. C. C. Clawson, of Raleigh, N. C., exhibits an automatic machine for packing tobacco and other articles. It weighs out the article, packs it in bags, and delivers the packages at the rate of thirty per minute.

Mr. William F. Gregg, of this city, exhibits some fine astronomical and engineering instruments, among which may be mentioned a thirty-inch time transit, a four-inch telescope, and a fine equatorial stand for a six-inch telescope. He also exhibits a new form of stereograph.

Several Holtz electrical machines are exhibited by Mr. Curt W. Meyer, of New York, who also shows some interesting apparatus for schools and amateurs.

EXPORTATION OF VULCANITE EMERY WHEELS.

The New York Belting and Packing Company have been receiving for some years large orders for their vulcanite emery wheels from England, where they are used in the government arms manufacturing works an Enfield, near London. They have also, for a considerable time back, been supplying these wheels for the use of both English and Continental manufacturers of fine cutlery, machine tools, and implements of precision, their superiority over English emery wheels for nearly every kind of grinding, cutting, and finishing being thus practically recognized. The success of the company in this field, almost within the bailiwick, as it were, of a business in which England claims especial preeminence, is particularly creditable to its managers and to their goods, and cannot fail to be gratifying to American mechanics generally.

The solid emery vulcanite wheel is an American invention, to attain complete success in the manufacture of which the company devoted years of laborious application, making thousands of costly experiments, and constructing therefor elaborate and expensive machinery. It was a branch of the business which, starting with the most ample facilities, and using only the best rubber, presented peculiar difficulties, for the problem was far more complicated than any which came up in other departments of the vulcanizing process. Aside from the nice distinctions always necessary in the mixing and vulcanizing processes of the rubber manufacture, they had still more difficult points to overcome in making wheels which would be sufficiently strong to run at a circumferential velocity of from 5,000 to 7,000 feet per minute, and which would have only just enough rubber in them to bind the emery closely, so that the wheels would wear perfectly even without glazing, would not soften by heat nor become brittle from cold, and would be throughout of such uniform texture and density that their work could always be depended upon. How well they have succeeded in overcoming these difficulties, and also in perfecting the mechanical details for mounting, truing, and turning off wheels, the greatly increased demand affords the best proof.

There have been but few improvements which have within the past twenty years worked such important changes in the way of economizing work in the machine shop and finishing room as has been effected by the emery wheel. The many different grades in which it is made, each different from the preceding by the slightest variations, fit it alike for almost every kind of grinding and polishing. Its handiness and general adaptability have enabled it to drive out the use of the grindstone, to a great extent, in the saving files to the value of millions of dollars, and greatly reducing the amount of work for which lathe tools were formerly used, so that it is now generally employed by workers in wrought, cast, and chilled iron, hardened steel, slate, marble, glass, etc. In the marking of hardware, cutlery, and edge tools, it has become indispensable, while it has also effected a great saving of labor in the manufacture of plows, safes, stoves, agricultural implements, and small machinery of almost every description. It is, therefore, a matter of considerable credit to American inventive genius and mechanical skill that the rest of the world should be indebted to us for the introduction and continued manufacture of the best articles in so important a specialty.

DECISIONS RELATING TO PATENTS.

By the Commissioner of Patents.

(*Appeal from the Board of Examiners-in-Chief.*)

HOCKHAUSEN *vs.* WESTON.—DYNAMO-ELECTRIC MACHINE.—INTERFERENCE.

Application of William Hockhausen filed January 28, 1878. Application of Edward Weston filed December 13, 1877.

Marble, Commissioner:

1. A machine which embraces all the features called for by the issue in an interference in such a manner as to be capable of successful operation will serve to give date to an invention, although such machine fail to show additional features which give increased efficiency to the perfected machines.

2. Objections to the patentability of a claim constituting the issue in an interference should be urged by a motion for dissolution of the interference, and not by an attempt to restrict the scope given by the Examiner to such claim.

3. In both the courts and the Office abandonment is an ill-favored finding, and cannot be presumed, but must be conclusively proven.

4. The charge that an applicant is not an original inventor must be sustained by proof of a most conclusive character.

HOPKINS *vs.* LE ROY.—JOURNAL BEARING.

Application of D. A. Hopkins filed November 20, 1879. Application of T. V. Le Roy for reissue of patent No. 221,737, granted November 13, 1879, filed June 5, 1880.

Marble, Commissioner:

1. When a party files a preliminary statement it is to be presumed that he has fully canvassed all the facts in the case and has correctly stated the same, and unless a request to amend the statement is made before any testimony has been taken all parties have a right to proceed on the issue as made in the respective statements.

2. A party has no right to wait until his opponent has fully developed all the facts in his case, and then for the first time ask leave to correct errors in his statement; but if through carelessness or negligence he has failed to have such correction made he must suffer therefor.

WICKS *vs.* MCAVOY.—SHEET METAL CAN.—MOTION FOR REHEARING.

Marble, Commissioner:

1. The rules relative to the granting of rehearings in interference cases before this Office are those which govern the granting of new trials in the courts, and to motions for the same diligence is a prerequisite.

2. Misstatements in arguments of counsel will not warrant the granting of a new trial.

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Business and Personal.

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Chard's Extra Heavy Machinery Oil.

Chard's Anti-Corrosive Cylinder Oil.

Chard's Patent Lubricene and Gear Grease.

R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

For Sale, ready for instant delivery, 16″ x 42″ Corliss Beam Engine, 16′ x 2′ wheel, thorough repair. Price, f. o. b. at tide water, in New England, $1,250. S. C. Forsaith & Co., Manchester, N. H.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Requests for samples for steel pens from firms and the professions will meet with prompt attention by addressing the Esterbrook Steel Pen Co., 26 John St., N. Y.

Full book on batteries, etc., 25 cts. T. Ray, Ipswich, Mass.

Magic Lanterns, Stereopticons, and Views of all kinds and prices for public exhibitions. A profitable business for a person with small capital. Also lanterns for home amusement, etc. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

Light and Fine Machinery to order. Foot Lathe catalogue for stamp. Chase & Woodman, Newark, N. J.

Mr. Ely, of Afton, N. J., cut thirteen acres of heavy grass in five hours, July 2, with the Eureka Mowing Machine. It is the best mower made. Farmers send for illustrated circular to Eureka Mower Co., Towanda, Pa.

Palmer's Computing Scale Wanted. Address J. R., Box 773, New York.

Blake's Belt Studs. The strongest and best fastening for leather and rubber belts. Greene, Tweed & Co., N.Y.

Wanted.—A first-class Corliss Engineer wants a situation. Is a machinist by trade. Good reference given. Address, stating salary, to F. C. M., 32 Derne St., Boston, Mass.

Caution to Manufacturers and Others.—The attention of those interested is called to the fact that materials for covering hot air and steam pipes, boilers, etc., which purport to contain asbestos, should bear the name of H. W. Johns, 87 Maiden Lane, N. Y., who is the inventor, patentee, and sole manufacturer of genuine asbestos materials, comprising paints, coatings, cements, sheathings, roofing, etc.

Parties desirous of contracting for the construction of Wells of extra large capacity, may address P. O. Box 1150, New Haven, Conn.

For Sale, on account of increase of power, one 20 x 48 Corliss Engine, with three boilers and equipment complete. Now in use, but deliverable in November next. For particulars address Natchez Cotton Mills Company, Natchez, Miss.

Wanted—A Practical Mechanic to take charge of Pruning and other Shears Manufactory. Address A. Flesher, Leesburg, O.

Leather Belting, Cotton Belting, Rubber Belting, Polishing Belts. Greene, Tweed & Co., 118 Chambers St., N.Y.

The E. Stebbins Manuf'g Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

For Sale, on account of increase of power, one 24 x 48 Corliss Engine, with three boilers and equipment complete. Now in use, but deliverable in November next. For particulars address Natchez Cotton Mills Company, Natchez, Miss.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1½ Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

The Boomer & Boschert Press Co. have in daily operation, at the Am. Inst. Fair, a complete cider mill and cider jelly manufactory. New York Office, 15 Park Row.

Packing once tried always used. Phœnix Packing from 1-16 up in spools or on coils. Phœnix Packing Company, 108 Liberty St., N. Y.

Blake "Lion and Eagle" Imp'd Crusher. See p. 269.

Gas Machines.—Be sure that you never buy one until you have circulars from Terril's Underground Meter Gas Machine. 39 Dey St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Peck's Patent Drop Press. See adv., page 268.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Green River Drilling Machines. See ad. p. 269.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Eclipse Portable Engine. See illustrated adv., p. 252.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Emery, Solid Walrus Wheels, Leather for Covering wood wheels. Greene, Tweed & Co., 118 Chambers St., N.Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Clark Rubber Wheels adv. See page 237.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

4 to 40 H. P. Steam Engines. See adv. p. 252.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

For Separators, Farm & Vertical Engines, see adv. p. 220.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Yale Mills and Engines, see page 252.

Silent Injector, Blower, and Exhauster. See adv. p. 284.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted to send their full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 284.

For Wood-Working Machinery, see illus. adv. p. 285.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 285.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see ills. adv. p. 284.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 285.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 284.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 284.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 284.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 284.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 284.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. M. asks: 1. What is the best method of washing a pair of common working pants that is tolerably greasy so as not to discharge the color? Is there any way of fastening the dye before washing? A. It is impossible to wholly prevent the washing out of such dyes; still, if treated in the following manner, and not allowed to remain too long in the water, the effect of the washing on the dyes will be less apparent: water 1 gallon, soap ¼ lb.; boil to dissolve; add two oz. borax; dilute with about 8 gallons of water, work the goods through as quickly as possible, and rinse without wringing. An aqueous solution of 1 part copperas and 7 parts logwood extract may be used for reviving the faded color of cheap black goods. 2. How can I clean off the hard scale that has collected on the zinc of a medical battery? A. Try sulphuric acid diluted with two or three parts of water, and use a stiff wire brush. 3. What is the reason that copper is the only metal used for the apparatus in distilling spirits? A. Copper is a better conductor of heat, can be worked to better advantage, is less affected by the liquids, and less liable to color or otherwise affect the distillate. 4. Would wrought iron pipe do for a worm for distilling whisky? A. Spirit could be distilled in such a vessel.

(2) G. G. G. writes: 1. In directions for making an induction coil in SUPPLEMENT, No. 160, it says the secondary coil is made of No. 36 copper wire. What gauge is understood? A. American. 2. In making coils of other dimensions, is wire of the same size used? A. Yes. 3. Can you tell me what kind of cement will fasten leather to metal, and will not be affected by bisulphide of carbon? A. Gelatine dissolved in acetic acid.

(3) F. R. R. asks (1) how to remove and replace the substance inside the porous cup of a Leclanché cell. What is the substance? A. Remove the cement at the top of the cell, take out the carbon and remove the filling of the cell, soak both carbon and cell in warm water. Replace the carbon and fill the cell with granulated black oxide of manganese. 2. What is the rule for the proportions of an electro-magnet to get the greatest power from a given current of electricity? A. The maximum magnetic force is developed when the resistance of the coils of the electro-magnets in circuit is equal to the resistance of the other parts of the circuit—that is, the conducting wires and battery.

(4) C. M. D. writes: I have about 600 feet No. 40 silk insulated wire and desire to make an induction coil. What size shall I make my spool, and how much wire shall I use for my primary, to get good results with one small bichromate cell? A. Use two layers of No. 16 silk covered copper wire. Make the core of your spool four inches long and five-eighths inch diameter. Your other query lacks data. Repeat, giving length of lines and diagram of connections.

(5) J. W. W. asks: 1. What is the cause of the heat produced in the armature core (iron) of a dynamo-electric machine? Is it not largely due to the rapid reversal of the magnetic polarity of the iron? A. Yes. 2. Supposing two dynamo machines alike in every respect with the exception that one armature is wound with No. 14 and one with the same length of No. 16, would not the one with No. 14 produce a current of greater quantity or more heating property than the 16? A. It depends on the construction of the machine. In a large machine, having strong field magnets, the larger wire would produce the most effective current; but with a very small machine the smaller wire would be best.

(6) W. S. asks: 1. Is the Siemens-Halske as strong as the chromic acid battery? A. No. 2. How long will either of the above batteries work without attention, if run constantly for eight hours per day on a circuit with a resistance of about two ohms? A. The S.-H. sulphate of copper battery will run for several months. The chromic acid battery will run two or three days only. 3. How many Smee batteries will be required to develop the same power as six of the above? A. Six Smees are about equivalent to six S.-H. sulphate of copper batteries. Eight Smees would be about the same as six chromic acid batteries.

(7) F. R. R. asks: Does the improved Prud'homme battery have the same substance in the porous cup as the Leclanche? A. We believe the porous cell contains granulated carbon.

(8) A. R. asks: 1. Will a magnet give more attractive force than its weight? If so, what are the proportions? A. A good magnet will lift several times its own weight; but the amount lifted depends on the form of the magnet, on the quality of steel from which it is made, and on the degree of magnetization. 2. Will a magnet lose its force by continual use? A. Yes, generally. It depends something on the manner in which it is used. If, as in some of the telephones, there is an armature constantly in contact with the poles, it will not lose its power.

COMMUNICATION RECEIVED.

On the Tin Mines of Maine. By C. W. H.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 5, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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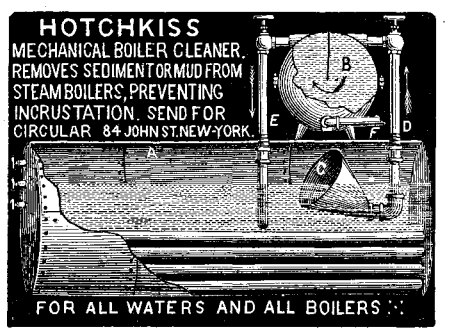
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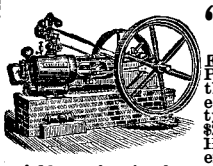

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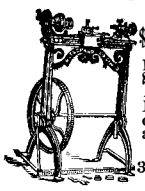

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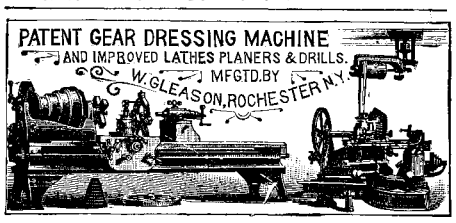

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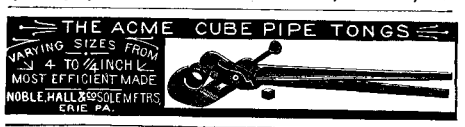

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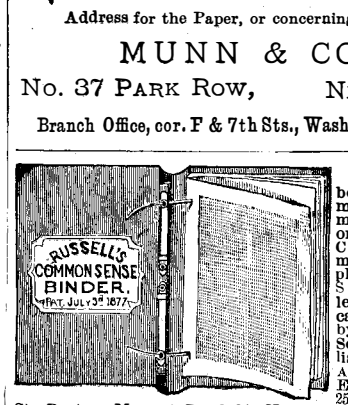

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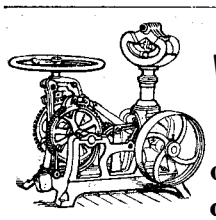

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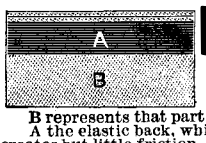

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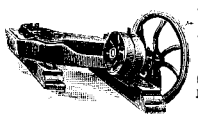

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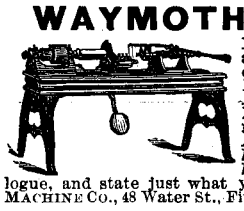

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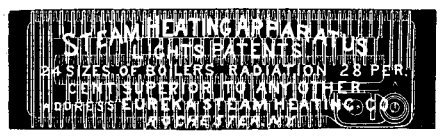
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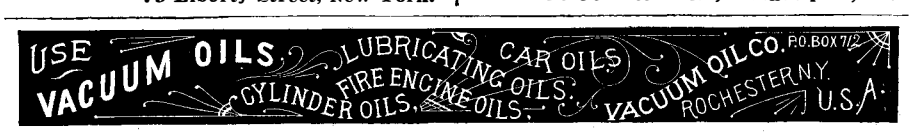

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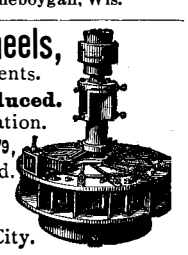

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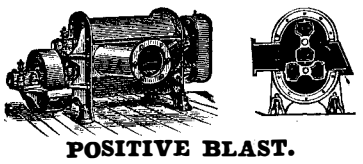

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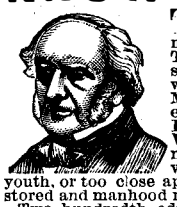

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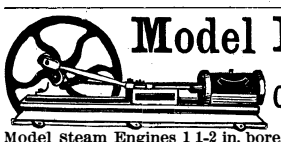

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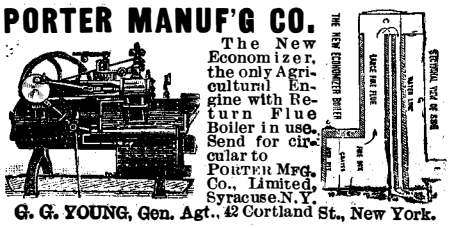

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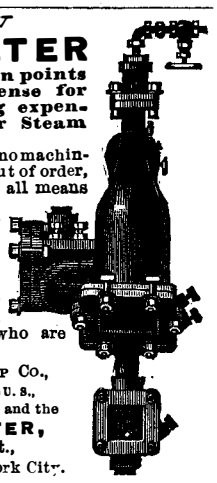

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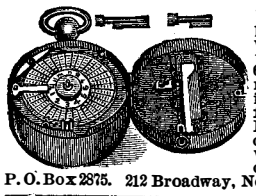

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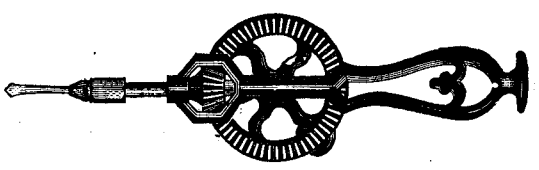

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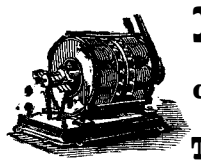

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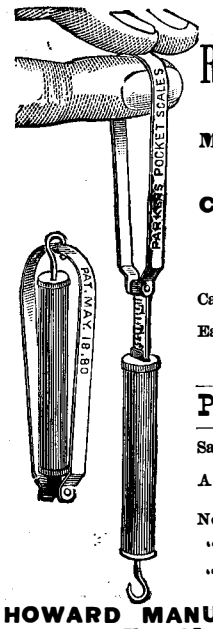

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